The Electrical Industry's Weekly Magazine

July 6, 1959

Electrical World

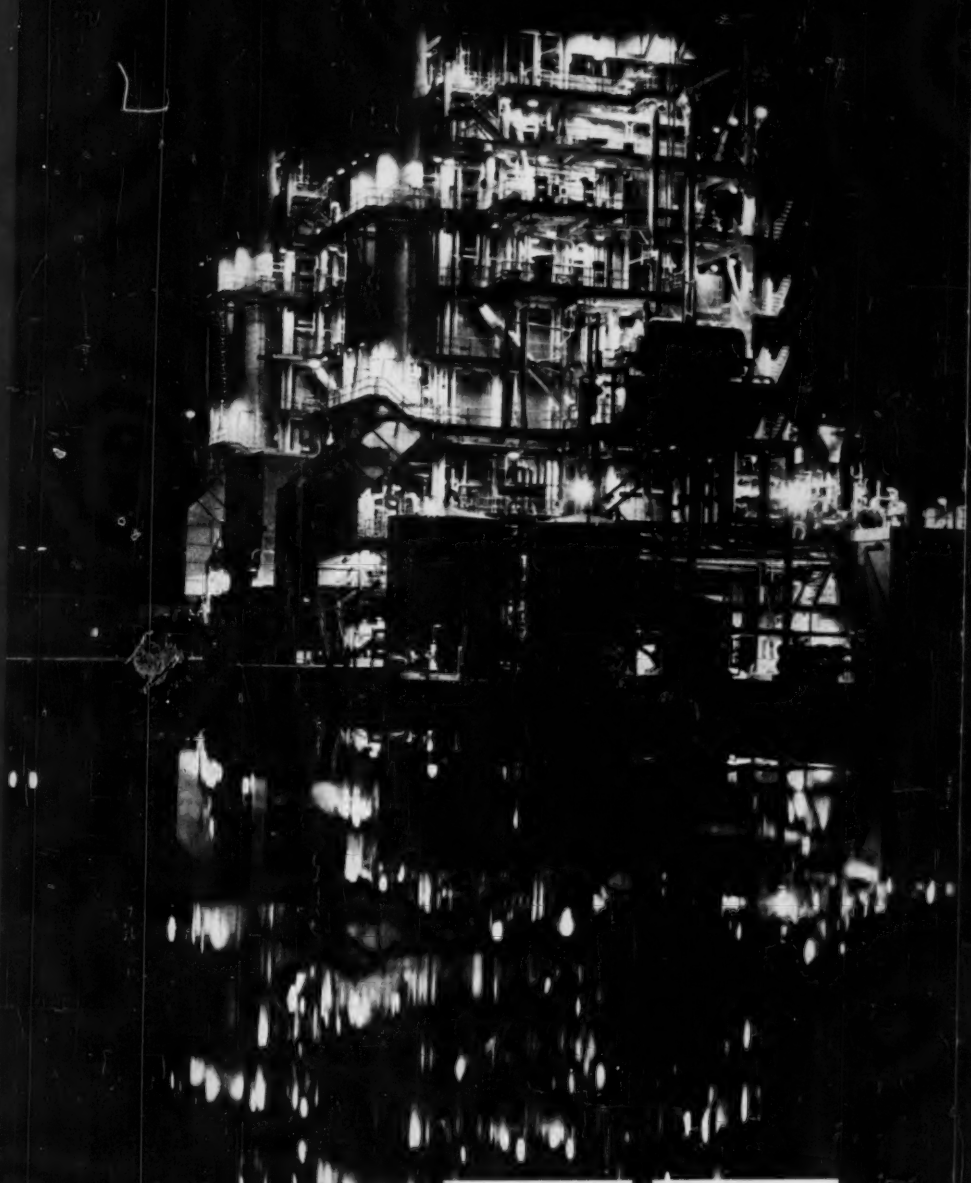
A McGraw-Hill Publication

Price 50 Cents

Steam Plant Combines Low Cost With Beauty...

...page 54

Russia Displays Power Advances at U.S. Show...p51



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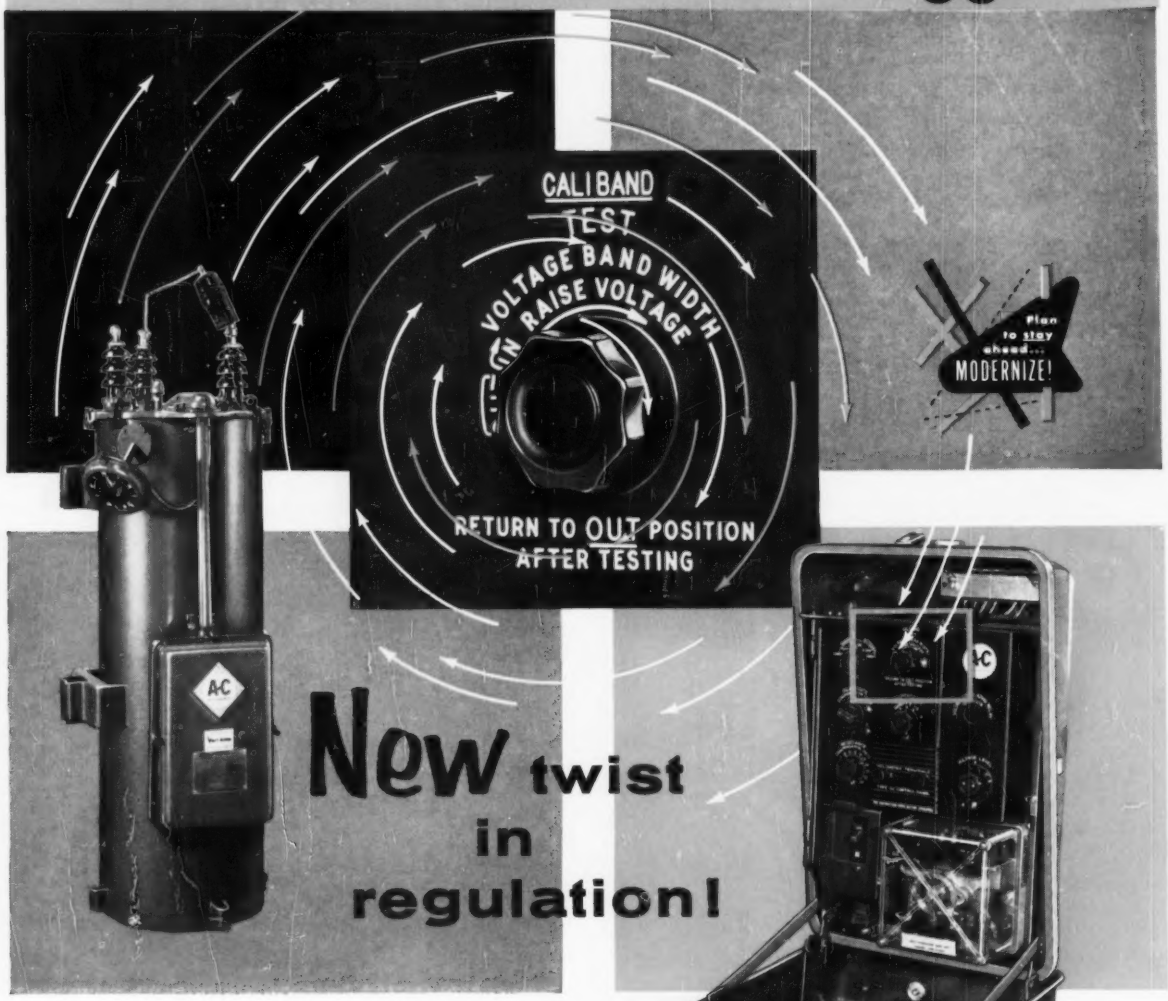


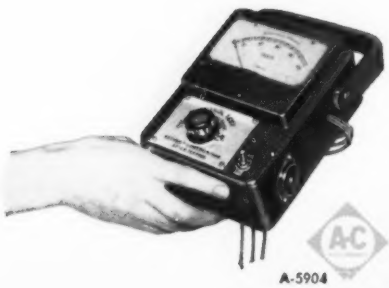
New twist in regulation!

Caliband control provides accurate settings quickly ... eliminates customer complaints

Now you can set or test voltage level and band width without changing customer voltage or interrupting regulated service. A twist of the *Caliband* control knob does it.

Caliband control demonstrator

Ask an A-C engineer to demonstrate *Caliband* control at your desk with an actual unit in a portable kit. Contact your nearby A-C office for a demonstration, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.



A-5904

Caliband is an Allis-Chalmers trademark.

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Originators of 5/8% step regulators

Electrical World

Vol. 152, No. 1 JULY 6, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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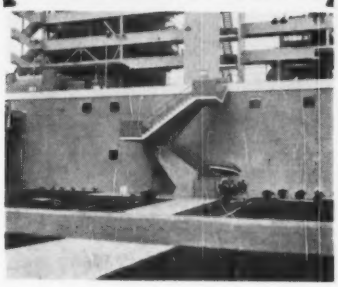

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American Assn of State Highway Officials work up national standards that promise to ease some stipulations....p 50

DISTRIBUTION

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A. W. Edwards, Westinghouse Electric Corp

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Capacitor Ends Flicker From Welder

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GENERATION

Steam Plant Can Be Attractive

T. M. Morong, Salt River Power District; K. H. Haig, Bechtel Corp

Salt River PD builds twin-unit, semi-outdoor Agua Fria for $105 per nameplate kw.....p 54

TRANSMISSION

Destruction Tests Aid H-Frame Design

W. D. Campbell, M. U. Dowell, F. L. Youngs, Central P&L

Simulated loadings carried to pole destruction prompt changes in X-brace, fittings, bolts, and anchoring.....p 56

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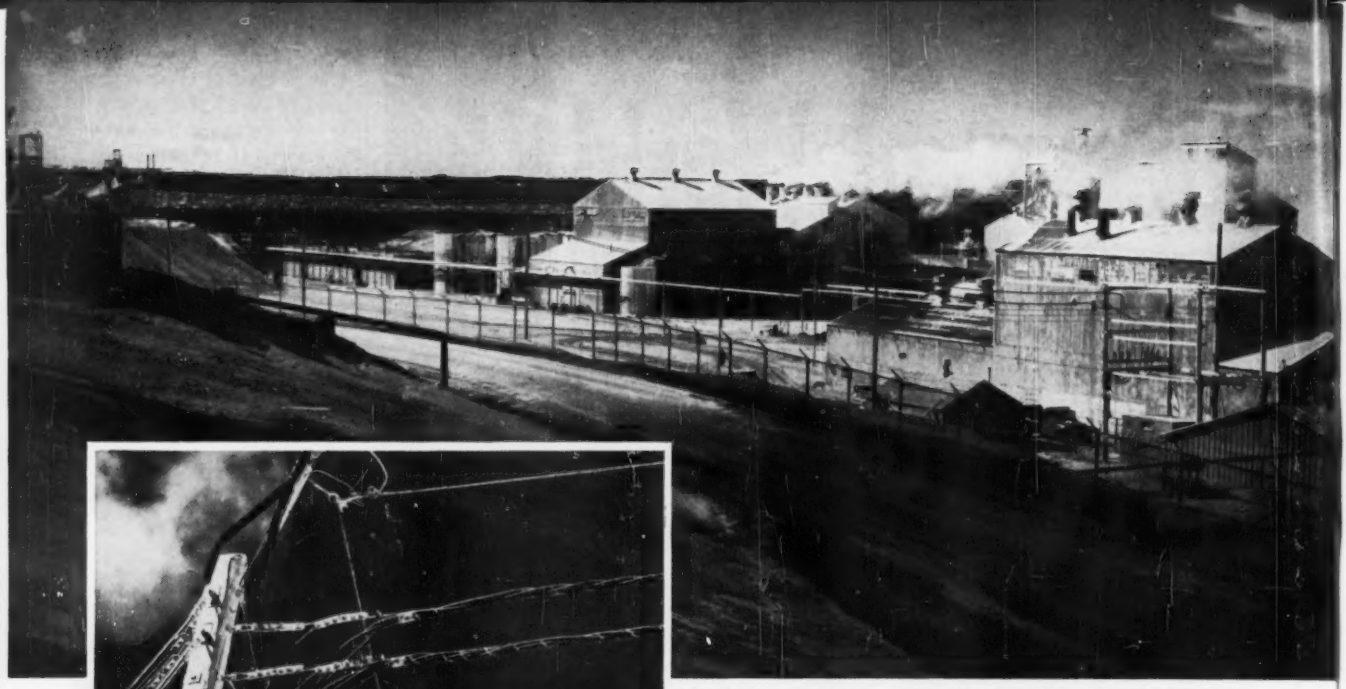

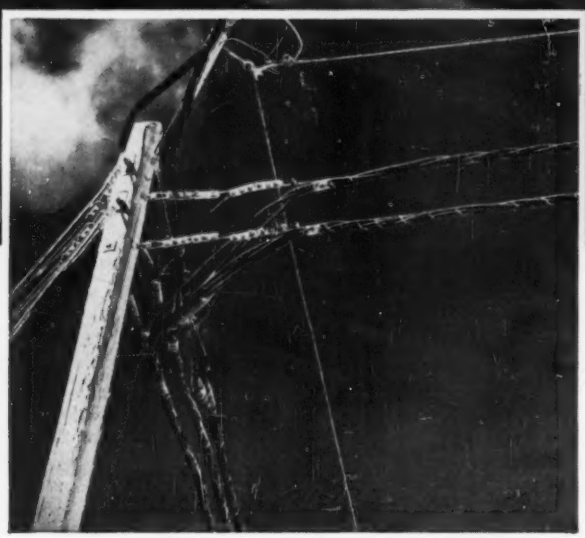

As the power goes . . . so go the operating costs at Intermountain Chemical Co.'s highly mechanized mining and refining operation. And every bit of this power—for digging, hoisting and processing of the ore—comes from Intermountain's power plant through 5kv non-shielded Okolite-Okoprene self-supporting aerial cables. They needed utmost dependability—and got it!

Heavy concentration of corrosive soda ash dust and severe environmental conditions have no effect at all on this aerial cable. Note the simple, low-cost support pole—no cross-arms needed—as well as the easy installation and splicing procedures used for this light weight, unshielded 5kv cable.

Okolite-Okoprene Aerial Cables withstand chemical contamination . . . assure continuous production at Intermountain

"These 5,000-volt aerial cables have withstood heavy concentrations of soda ash dust for eight years now," says Louis Ruffini, staff assistant to the maintenance superintendent for Intermountain Chemical Company of Wyoming. "They've proved to be invulnerable to temperatures as low as —40°F and as high as 120°. They've faced winds up to 70 mph, and they tested perfectly at 40,000 volts d-c. We expect them to be around a long time yet."

These facts are vital to Intermountain. The company depends almost completely on electrical power to mine trona ore and refine it into almost half a million tons of soda ash per year. That's why they stress the dependability of their Okolite-Okoprene, 3/c, self-supporting power cables with aluminum conductors, cables that distribute power to every sub-station in the mine and processing plant.

"Installation of the aerial cables was very simple," says Mr. Ruffini, "thanks to their flexibility, light weight, and self-supported Dualay construction . . . and due also to the unshielded 5,000-volt construction that permitted the simplest of splicing and terminating procedures."

For *your* power needs, this construction can offer installation and operating economies, combined with long-term dependability. Okolite insulation has a 30-year record of service, maintaining in severest installation conditions its high dielectric strength and great resistance to corona cutting, moisture and heat. Okoprene sheath offers unusual protection against weather, abrasion, ozone, heat, cold, many acids, alkalies and chemicals. Application by the strip process of both insulation and sheath is the final assurance of matchless performance and long life. For the Okolite-Okoprene self-supporting aerial cable that best suits your needs, see 56-page Bulletin EW-1074. It's free . . . just write The Okonite Company, Passaic, N. J.

***where there's electrical power . . . there's* OKONITE CABLE**

4216

In the Industry

Improving the Breed of Statistics

As of the beginning of 1959, the Edison Electric Institute launched a program to purify the reporting of customers and sales falling into the residential and commercial classifications. This is being done by entirely eliminating the rural classification which has become a useless and confusing statistic.

The dropping of "rural" will provide a more reliable indication of yearly changes in residential and commercial by eliminating the somewhat arbitrary switching of customers that has gone on between the three classifications.

For its long range thinking, the EEI Statistical Committee deserves the praise and the cooperation of the industry. The job it has tackled is a tough one which can only be successfully completed if each and every utility gives serious thought to the reclassification of its own statistics. This means not only cooperating in the changeover to the new reporting system but also cooperating in a revision of data for previous years. Thus the change can be made in an orderly manner without disrupting the enviable 30-year statistical record the industry has built.

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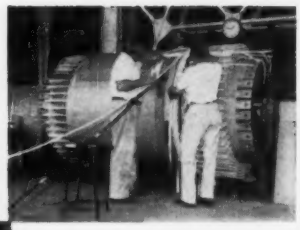
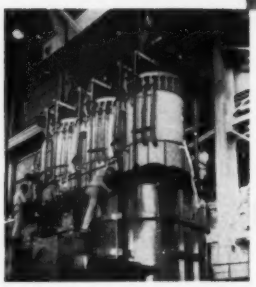
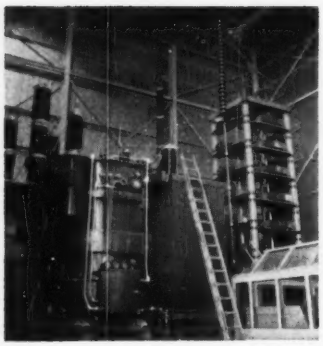




OF SKILL AND FACILITIES

Moloney's growth has paralleled that of the electric industry. This growth has been possible because of experience and know-how, skill and facilities . . . all backed by constant research and development programs which have sparked many industry firsts.

Moloney carefully studies industry trends, and utility needs are anticipated whenever possible. Co-operative development between Moloney and their customers is constant in both specific and industry-wide instances.



Skill and Facilities to manufacture large transformers of any type or size required . . . over sixty years experience in the manufacture of transformers . . . continuous product improvement . . . proven service records on utility systems throughout the country . . . are all good reasons for specifying Moloney Transformers . . . All Along the Line.

MOLONEY ELECTRIC COMPANY

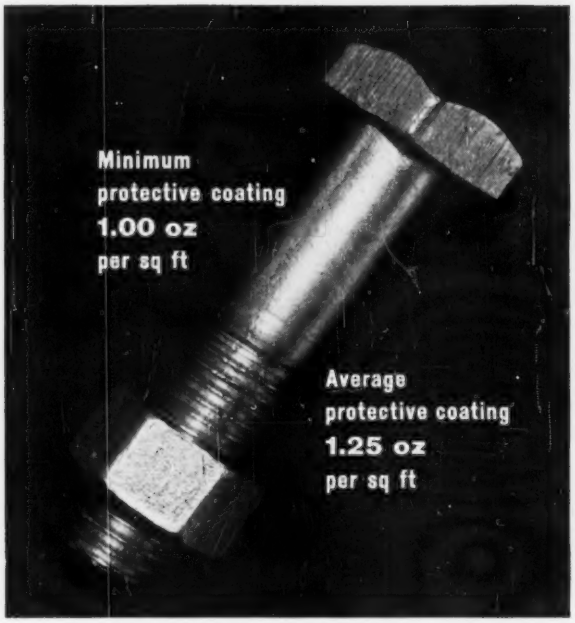
Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

ME58-24

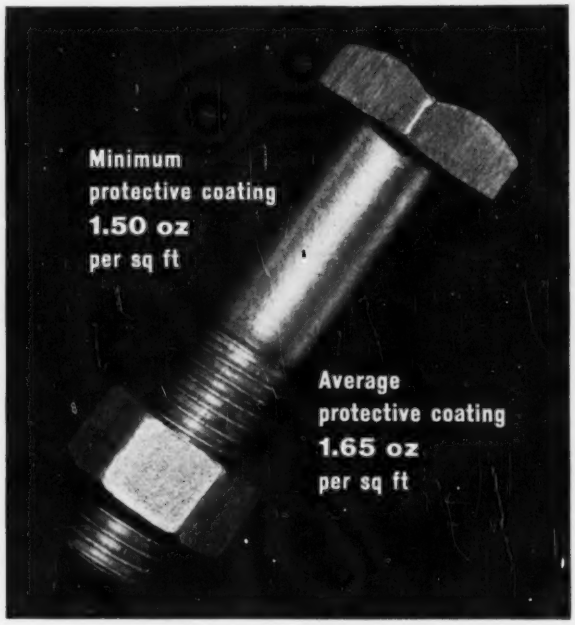
SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

MAGNETROL CONTROL
MOLONEY
ELECTRIC

These galvanized tower bolts look alike ...BUT...they won't last alike!



ASTM Specification A-394 requires the weight of galvanized coating shown above.



Bethlehem has developed a method of galvanizing tower bolts and nuts that results in a heavier weight of coating.

FACT: galvanized coatings protect against corrosion in direct proportion to the weight of coating.

FACT: because it is necessary to clean tower bolts and nuts by centrifuging, their coating weight is usually less than that of tower structural members.

FACT: the average coating on ordinary tower bolts and nuts is about *half as heavy* as the coating on the tower members themselves; such bolts and nuts can be expected to last only half as long as the tower members.

FACT: the average coating on Bethlehem galvanized tower bolts and nuts is more nearly equal to the coating on the tower members.

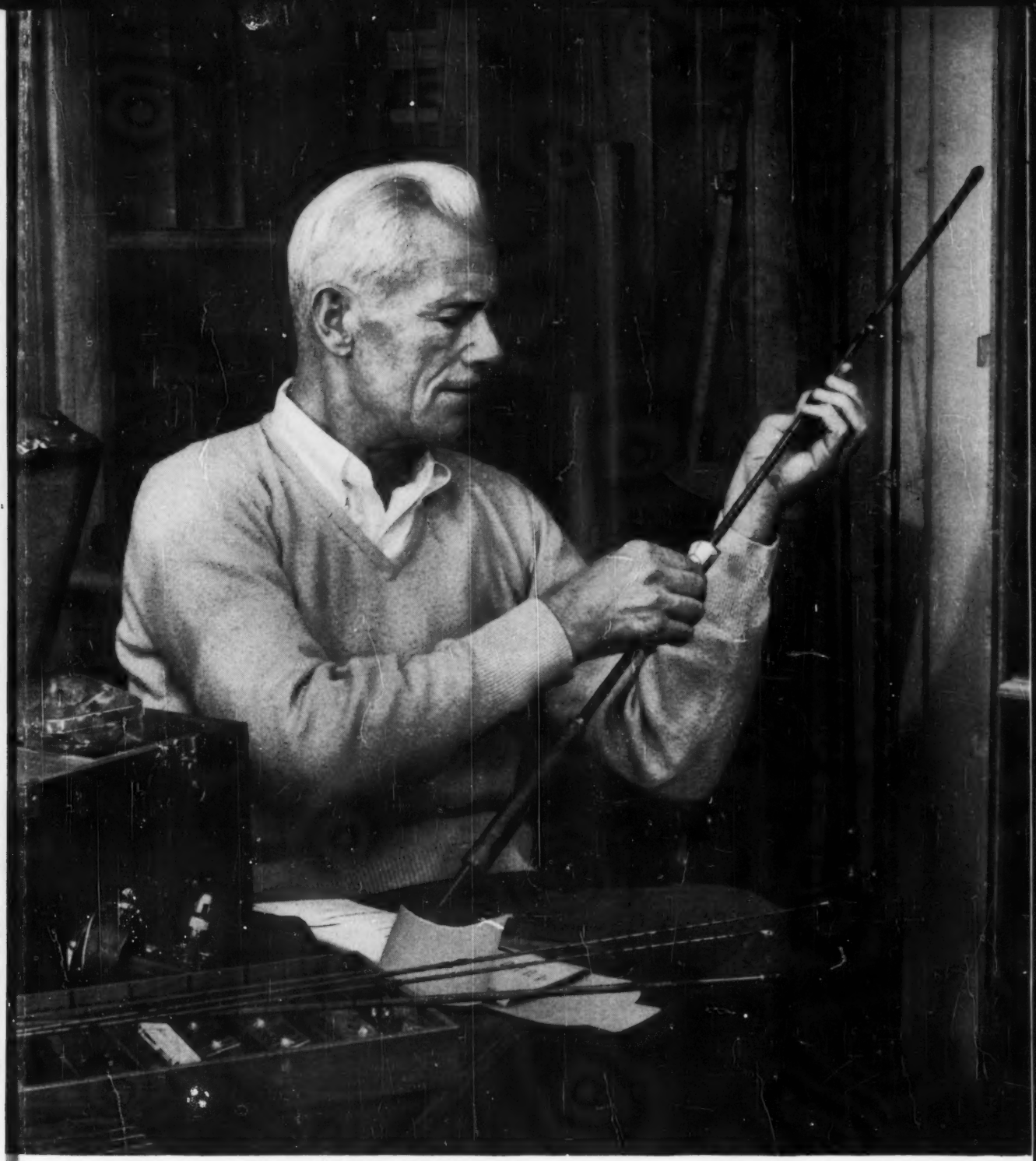
CONCLUSION: Bethlehem tower bolts and nuts will last longer, are well worth their slight extra cost. Let us give you full details.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



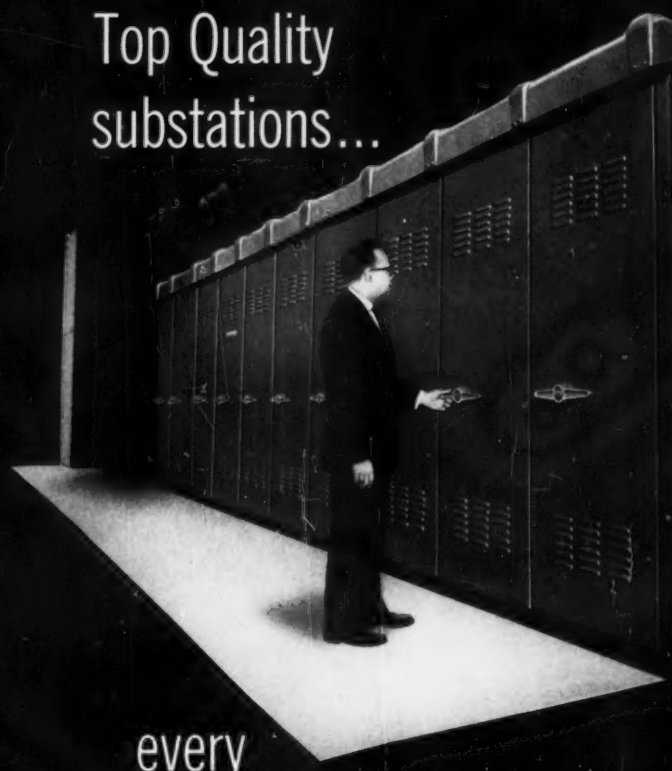
TIME IS THE MEASURE OF ALL WOOD PRESERVATION

Utility pole, railroad tie or prized fly rod – the question of wood preservation is important. . . . The answer for industry – proved by over 50 years of service records – is AMCRECO pressure treatment.

AMCRECO
PRESSURE TREATED WOOD PRODUCTS

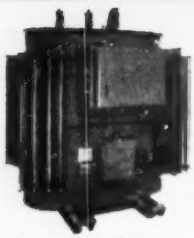
AMERICAN CREOSOTING CORPORATION LOUISVILLE 2, KENTUCKY
SUBSIDIARY OF UNION BAG-CAMP PAPER CORPORATION

Top Quality substations...

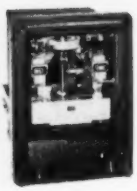


15 kv outdoor primary unit substation styled by Raymond Loewy

every major component manufactured by Federal Pacific

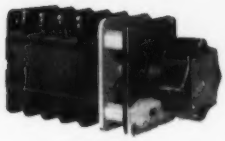


Power Transformers



Protective Relays

Indicating Instruments



Instrument Switches

Potheads

High Voltage Air Breakers

For single-source responsibility and reliable operation, look to Federal Pacific, one of only three companies to manufacture every major component of its primary unit substations. Federal Pacific's unit engineering, coordinated assembly, integrated quality control assure you built-in reliability and longer substation life. Federal Pacific Electric Company, General Offices: Newark 1, New Jersey.

FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

The Best in Electrical Distribution and Control Equipment

The Electrical Week

FUTURE NEWS ▶ **Look for a delay on the proposed Bonneville-California tie study.** The Senate asked for the report by July 15, but it probably won't be ready for about six months. Reason: The joint study group, made up of officials from private, public, federal and state agencies, may have to resolve a lot of internal difficulties first.

LATE NEWS ▶ **Washington Wire** . . . FPC authorizes South Carolina Public Service Authority to raise water level at its Wilson Dam on the Santee River from 75 to 76.8 ft . . . FPC also grants Lewis & Clark G&T Cooperative two-year preliminary permit to study proposed 25,000-kw hydro project on Yaak River. Power would be used entirely by 10 co-ops which own Lewis & Clark . . . Interior Dept announces approval of power integration contract between Idaho Power Co and three Bureau of Reclamation projects for 30,000 kw of firm power from the three.

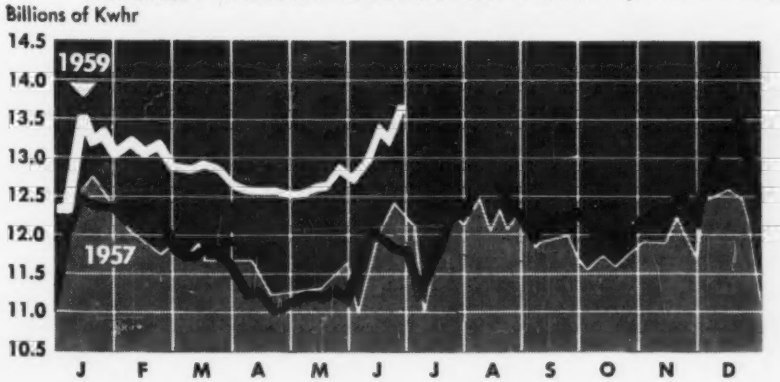
IBEW strikes at Public Service Co of Indiana after contract negotiations stop. The company is manning its properties with supervisory workers.

Duke Power offers new contract to South Carolina towns in which a percentage of its gross receipts are paid in lieu of taxes.

Management changes . . . Atlantic City Electric names C. O. Carlson and J. P. Hayward exec vps . . . L. R. Patterson elected vp at Public Service of Colorado . . . John Eilering named division vp at Commonwealth Edison . . . C. F. Moulton becomes general manager, Omaha Public Power District. E. E. Schwalm is new assistant general manager.

Obituaries . . . R. N. Hill, board chairman and former president, Green Mountain Power Co of Burlington, Vt., died in that city on June 24 . . . Joseph Franz, consulting electrical engineer for several Massachusetts utilities, died in Stockbridge, Mass., June 23.

WEEKLY POWER OUTPUT—UP 16.9% (Week ending June 27), Kwhr 13,749,000,000



Per Cent Change From Previous Year

	June 13	June 20	June 27
Total U. S.	+11.5	+11.6	+16.9
New Eng.	+11.4	+10.8	+11.4
Mid Atlantic ..	+16.0	+ 9.8	+16.4
Cent. Ind.	+17.9	+16.7	+21.5
West Cent.	+11.3	+15.2	+21.4
Southeast	+ 3.7	+ 5.3	+12.8
South Cent.	+ 1.2	+ 7.7	+16.4
Rocky Mount ..	+10.0	+14.5	+15.3
Pacific			
NW	+18.7	+18.5	+18.5
SW	+15.3	+14.2	+15.9

Seasonally Adjusted Index 258.6

Week ago 250.3 Year Ago 221.1

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Does it pay to have investment people visit your service area?** Judging from reactions of executives who examined industrial developments in Southern Co's area, the answer is an emphatic "Yes!" **(p 48)** . . . Another tack that's paying off for utilities is liaison work with highway men. It helped ease some tough requirements in a set of new national standards on relocations **(p 49)** . . . Recent changes in pending TVA revenue-bond bills promise a creeping service area concept along with some closer Congressional controls **(p 50).**

ENGINEERING ▶ **A low-cost steam plant doesn't have to be unattractive.** The esthetically pleasing appearance of Salt River Power District's 200-Mw Agua Fria plant—with its steel siding, cantilevered stairs and platforms and landscaping—proves the point. Details on **page 54** . . . Central Power & Light structure tests on a 69-kv, H-frame line dictated changes in framing, fittings and anchoring to survive hurricane conditions **(p 56)** . . . Operating as well as first cost must be considered in evaluating distribution transformers **(p 60)** . . . Series capacitor cures flicker ills for Rochester G&E **(p 60).**

PROCUREMENT & PRODUCTS ▶ **Montana Power gets lease on coal lands,** insuring future low-cost fuel supply . . . Copper fabricators able to keep going a month if producer

Politics and Public Power

ETHICS, FUNCTION AND THE FPC

The remedy could be worse than the disease. So testified a number of industry and government witnesses recently before the House Legislative Oversight Subcommittee, which is considering legislation to improve "ethical standards" before the Federal Power Commission and other federal agencies.

The subcommittee is concerned with ending or limiting informal, off-the-record talks (1) between commissioners of regulatory agencies and industry leaders and (2) between commissioners and their own staff members. These "ex parte" discussions can, and sometimes do give advocates in a pending case the opportunity to influence decisions without their opponents having an opportunity to rebutt—or even be aware of—such discussions.

Two bills introduced by Subcommittee Chairman Oren Harris (D-Ark.) are aimed at correcting some admittedly serious breakdowns in propriety before federal regulatory bodies. But the bulk of testimony before Harris' subcommittee emphasized that the FPC would be hampered by general legislation aimed at all regulatory agencies without taking into account its special needs.

Randall J. Leboeuf, Jr, attorney for power and gas companies before the FPC, told the House body, "I look with scepticism on legislative enactments which, although designed to prevent possible abuses, I fear will delay, complicate and hamper the FPC in the proper performance of its duties . . . The FPC . . . in order to perform its numerous functions in the public interest . . . must have the maximum independence and be not only free from improper influence, but also from unduly restrictive and inappropriate legislative procedural rules . . . I would like to make the general observation that both HR-4800 and

strike comes . . . Aluminum could recover 1.3¢ price drop . . . Industry worries about crude-oil price shakedown . . . McGraw-Hill sees $700-billion economy by 1969 **(p 66).**

MANUFACTURERS ▶ **Line Material's self-regulating transformer** is electronically controlled . . . I-T-E Circuit Breaker develops high-voltage switch that is enclosed in section of 138-kv isolated phase bus . . . GE to build automated control system for Southern California Edison **(p 68).**

NEW EQUIPMENT ▶ **Mobile radio has battery drain of 0.04 amp in "standby" position** . . . Open-type cutout of 27-kv rating has been added to "F2" cutout series . . . Strip chart recorder has new month-long inking system **(p 84).**

MANAGEMENT ▶ **There's still one puzzle in the annual report** of the average utility, despite the great improvements that have been made in narrative, layout and illustration. It's the section containing financial statements, and it still baffles many stockholders. Turn to **page 79** for a few ideas that help throw some light on these last few dark spots.

SELLING ▶ **Central Power & Light sales program builds balanced load.** It pushes up kwhr use as well as producing better load factor **(p 75)**

HR-6774 (Harris' two bills) prescribe uniform regulations for each of the six regulatory commissions. Since their functions differ so widely, it would seem that any such blanket approach is unworkable . . . I believe that the (Federal Power) Commission is best fitted to draft such rules."

Basically, the bills would require all federal commissions and persons appearing before them to conform to ethical conduct standards similar to those required by the courts. Ex parte contacts between the commissions and their staffs, and between the commissioners and various industry representatives would be halted or restricted.

FPC Chairman Jerome Kuykendall insisted that FPC is "basically different" from other agencies in that it must examine and test technical plans brought before it. Ex parte contact with staff members is needed by the commissioners for "technical assistance and facts, not argument," he pointed out.

Spokesmen from several natural gas companies regulated by the FPC hit the bills as detrimental because they would hurt or destroy necessary relationships between the commission and the industry.

At one point in the hearing, FPC and industry witnesses sat back and listened to an unregulated crossfire between Reps John Bennett (R-Mich.) and John Moss (D-Calif.) on whether members of Congress should be allowed to contact the commission on cases affecting their districts.

No, said Bennett, because in any case before the FPC, some private group would benefit, and Congressmen should not be in the position of helping parties in such cases.

Yes, said Moss, because the general public in a Congressman's district is always affected in any given case, and he would have the duty of speaking either for or against such plans.

Executive Reader

NUCLEAR NOTES

A comprehensive, ten-year civilian power reactor program is being formulated by AEC's Division of Reactor Development. Jan. 1, 1960 is the target date for the plan's completion, but it may take longer.

For each reactor concept being investigated, the plan will:

1. Delineate specific technical objectives.
2. Outline a chronological development program of basic research, fuel cycle development, plant construction and operation.
3. Evaluate economic potential, with time schedule and development and construction costs taken into account.
4. Set yardsticks for rate and degree of development.

Ulysses M. Staebler, AEC Div of Reactor Development, American Nuclear Society annual meeting, June, 1959.

Permanent contamination due to defective fuel charges has very low probability of occurrence in a nuclear power reactor. This means plant abandonment for this cause is very unlikely. Recent tests at GE's Vallecitos boiling water reactor deliberately inserted defective fuel segments in the core for six days at full power. Yet contamination showed up in neither coolant nor turbine. **H. Imhoff et al, General Electric Atomic Power Equipment Dept, American Nuclear Society annual meeting, June, 1959.**

"One Year of Operating Experience at Shippingport" describes in complete detail operations and tests between initial criticality (Dec. 2, 1957) and Nov. 30, 1958. The 188-page article occupies the complete Bettis Technical Review issue for April, 1959. It is available from the Office of Technical Services, Department of Commerce, Washington 25, D. C., at $3.50.

The Shippingport PWR Test Program still continues. At the end of the first year, it consisted of about 175 basic tests of one or more sections each. Raw data is being processed by digital computer. Typically important experiments are six-week long Reactivity Lifetime Tests, spaced six weeks apart.

An interesting deviation from conventional thermal plant characteristics is that Shippingport's generator can be operated synchronized with the Duquesne Light system at zero net output in readiness for instant load demands—and for extended periods—without ill effect. **Bettis Technical Review, April, 1959.**

Sure it will work on EHV!

For anyone planning an extra-high voltage line, it's good to know that workable hardware and insulator designs have already been established and proved through performance.

Take the matter of shielding the lower suspension insulators in a string, the suspension clamp and conductor. Most power companies want to hold RIV for extra-high voltage at the same level as 138-kv or 230-kv lines that are already operating satisfactorily. Made for that kind of control, the inexpensive shields shown here have been performing successfully for seven years. Designs were developed which gave maximum control with little reduction in flashover value.

When shielding questions arise, you can see the benefit of having experience with design and manufacture of both insulators and hardware. Since O-B is the only manufacturer that makes both, we naturally have an advantage. It's an advantage we're happy to pass along to you in helping solve your EHV problems.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass (B) HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

Choose

Extended foil cooling minimizes temperature-rise, increases life expectancy of O-B capacitors

cool VAREX®

for long life

Heat in a capacitor is an inevitable result of its being submitted to electrical stress.

However, the amount of temperature rise can be held to a minimum by design factors, use of quality materials and elimination of contamination.

The design principle responsible for efficient cooling in Varex elements is the extension of aluminum foil at each end of the element. There is an unobstructed path for heat flow from the center to the end of the element. A minimum thermal barrier between element and case also promotes efficient heat flow to the sides of the container.

No one can tell you for sure how long a capacitor will last when installed on your lines. But one of the most important influences on capacitor life is its operating temperature. For every eight to ten degrees centigrade increase in operating temperature, capacitor life is reduced by an estimated 50 per cent. This is particularly important when the ambient or hot spot temperature exceeds the operating limits recommended in Capacitor Standard ASA C55.1.

Foil-cooling, as developed in Varex, is an effective way to hold temperature-rise to a minimum. That's why you can expect longer capacitor life when you specify Varex for your system.

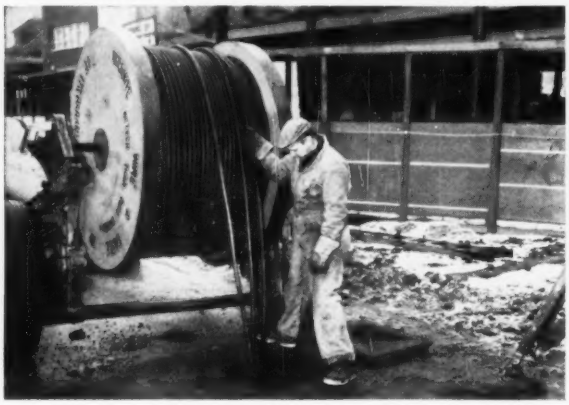
OHIO BRASS COMPANY, MANSFIELD, OHIO

4966-H

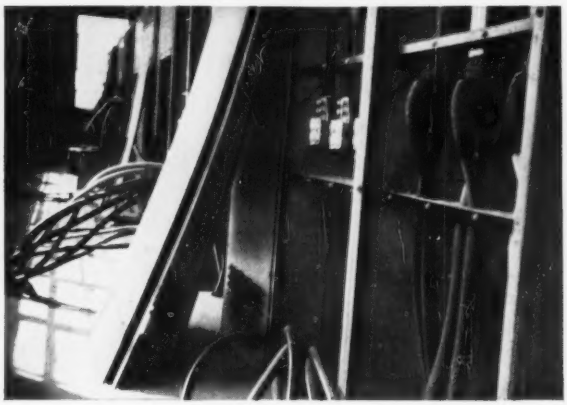
Ohio Brass ® HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

Installed in underground ducts, Paranite Super Pararite-Paraprene® network cable services a modern electronic computer installation.



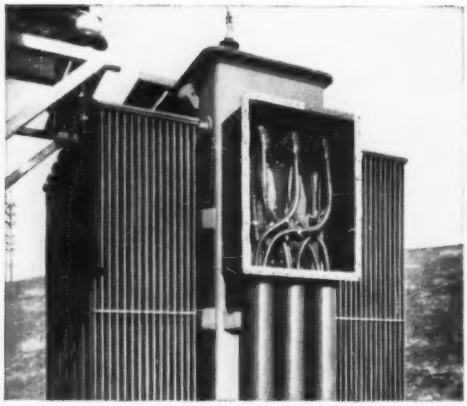
Paranite Super Pararite-Parasyn cables carry primary power between transformers and switchgear control panels in an ore reduction plant.



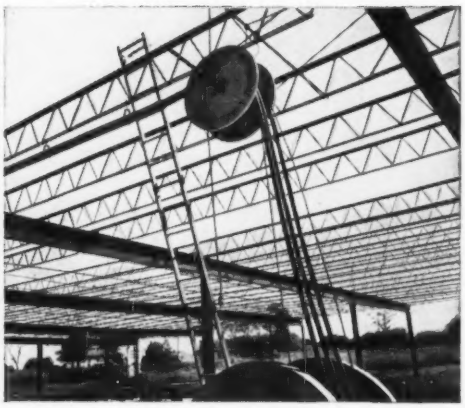
Across the nation for trouble-free installations...

PARANITE®

"IF IT'S PARANITE IT'S RIGHT"®



Paranite Super Pararite-Paraprene cable serves as the primary transformer feeder in a new municipal water pumping station.



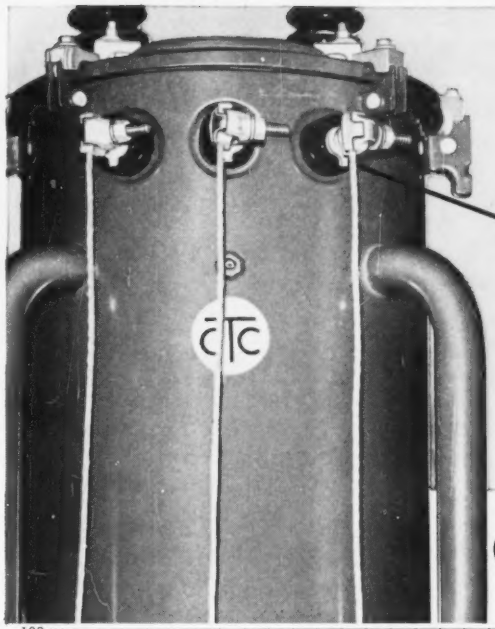
Overhead duct installation of Paranite Super Pararite-Parasyn® (PVC) serves as a secondary feeder cable in a manufacturing plant.

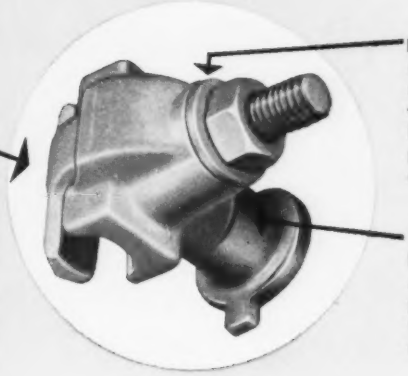
The consistent selection and performance of Paranite cables from 600 volt network through 23,000 volt power cables mark them as products of close quality control. These Super Pararite-Paraprene and Super Pararite-Parasyn (PVC) cables illustrated above, indicate the versatility, national availability and proven trouble-free performance of Paranite installations.

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Fort Wayne, Indiana

MANUFACTURING PLANTS: Marion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Birmingham, Ala.; Anaheim, Calif. • Sales Offices in All Principal Cities

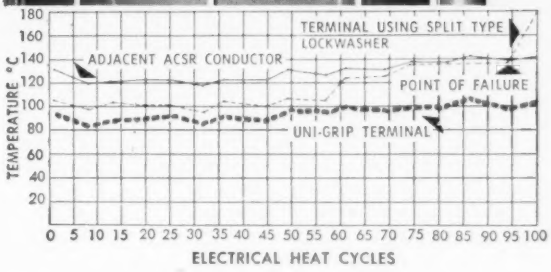


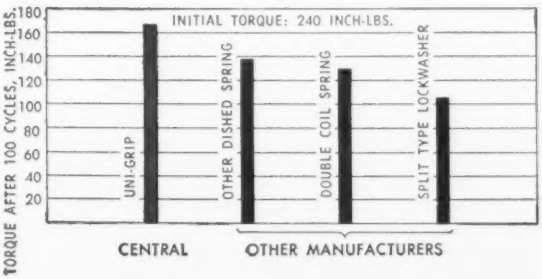


EXCLUSIVE! High carbon steel dished washer of special design, zincplated with chromate conversion. Maintains pressure, compensating for aluminum conductor "cold flow".

Flowed tin plating on bronze body and eyebolt assures maximum compatibility corrosion-wise with either aluminum or copper conductors.

Central's New "UNI-GRIP" Transformer Terminal Solves Your Aluminum Clamping Problems!





HEAT CYCLING AND TORQUE TESTS PROVE SUPERIOR PERFORMANCE OF CENTRAL'S NEW TERMINAL FOR USE WITH BOTH COPPER AND ALUMINUM CONDUCTORS!

Central's revolutionary new universal terminal—"UNI-GRIP"—represents the most outstanding advancement to date in solving the problems of clamping aluminum conductor.

Its superior performance over other types of terminals has been established by extensive heat cycling and torque tests.

"UNI-GRIP" combines a new spring washer, flowed tin plating and increased contact area.

Central's new terminal was designed and perfected by Anderson Electric Corporation, Birmingham, Alabama, in cooperation with Central engineers.

PLUS . . . ALL STANDARD FEATURES

- Components are quality-control-tested by ASTM's Mercurous Nitrate Specification B154-51 to insure against stress corrosion cracking, and season cracking.
- Connector contact design configuration correct to prevent separation of conductor strands.
- Contact surface areas sufficiently large and smooth to prevent damage to conductor under pressure.
- Eye-Bolt entrance rounded to prevent cable damage.
- Bushing, terminal and transformer tank interlocked to prevent turning.

Just one more reason why Central Transformers are **PREFERRED** *throughout the Nation*

CENTRAL CTC

Sales Offices in Principal Cities

Transformer Corporation

Telephone JEfferson 4-5332

PINE BLUFF, ARKANSAS

NEMA

Let's take a closer look at Demand Metering . . .

Why Call it Demand?

Does the word "demand" make you bristle?

While we all know that demand charges are fully justified from the standpoint of basic economics, the electric power customer often fails to realize that it is he who is making demands on the utility rather than the other way around. If psychology has a place in rate-making, should the word "demand" have ever been admitted to the electric utility vocabulary?

Today, when demand metering is being applied to the measurement of more and more residential loads, seems to be a good time to reconsider our use of the word. Electric customers, tabbed with a *demand* charge on their electric bills, have a tendency to bristle at the term.

If we remove *demand* from demand metering, it becomes a more acceptable concept . . . and if we substitute a logical and less offensive word in its place such as load, peak, or power, we have a more readily understood term.

What's your suggestion? We would like to hear from you. Address Glenn M. DeKraker, Sangamo Electric Company, Springfield, Illinois.

Acknowledged Leadership in Demand* Measurement

Sangamo offers the most complete line of demand measuring devices in the industry —equipment to indicate and record demands from the smallest values to the largest encountered by the electric power industry. The line includes singlephase and polyphase mechanical demand registers, thermal demand meters, indicating and graphic meters, digital demand recorders and translating systems for Kw, Kvar, and Kva demand. You can look to Sangamo for all types of demand devices.

*Until you change the term "demand".

JM59-3

SANGAMO ELECTRIC C

Do you use THERMAL DEMAND?

The compact singlephase or polyphase Sangamo watthour and Lincoln demand meter combines the new features of Sangamo's watthour meters and Lincoln watt demand meters. These meters are calibrated at the factory to 1% of full scale.

Accuracy assured by carefully matched components that are completely shielded. Only two moving parts assure minimum maintenance.

Where future load growth is anticipated, capacity of the demand element can be doubled by changing two link connections and the demand scales.

. . . OR DO YOU PREFER

MECHANICAL DEMAND . . ?

Sangamo's new Type D mechanical demand register, when installed on any of the Sangamo extended range J2 and P2 watthour meters, gives the most accurate indicating demand measurement available. You get 1% full scale accuracy.

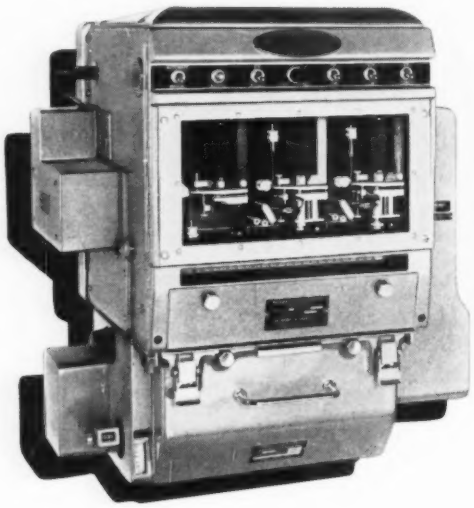
The heart of the demand register is the motor. With over two million Type H motors in service, it offers proven reliability in addition to higher torque, slower speed and higher insulation levels.

Universal and standard Type D registers were designed to give better disk visibility, better service accuracy, time interval indication, and simple disengagement of timing motor for register checking.

COMPANY, Springfield, Illinois

50TH ANNIVERSARY SANGAMO 1910 - 1960

HAMILTON RS-9 FOURTEEN AUTOMATIC OSCILLOGRAPH



NOW PRICED WITHIN YOUR BUDGET

Monitor your protective system with an RS-9 FOURTEEN

Now, with research and development costs amortized, the price of the Hamilton RS-9 Fourteen Automatic Oscillograph has been reduced, placing it within easy reach of every power company.*

The Hamilton RS-9 Fourteen Automatic Oscillograph constantly stands watch over your protective equipment. It gives you a permanent, comprehensive record of the operation of your system under fault conditions—providing you with the PROOF you need of the sequence of relay and breaker operation. It shows when a relay or breaker is slow acting or erratic before it can cause system damage and costly down-time.

The RS-9 Fourteen is designed specifically for use in power plants and sub-stations.

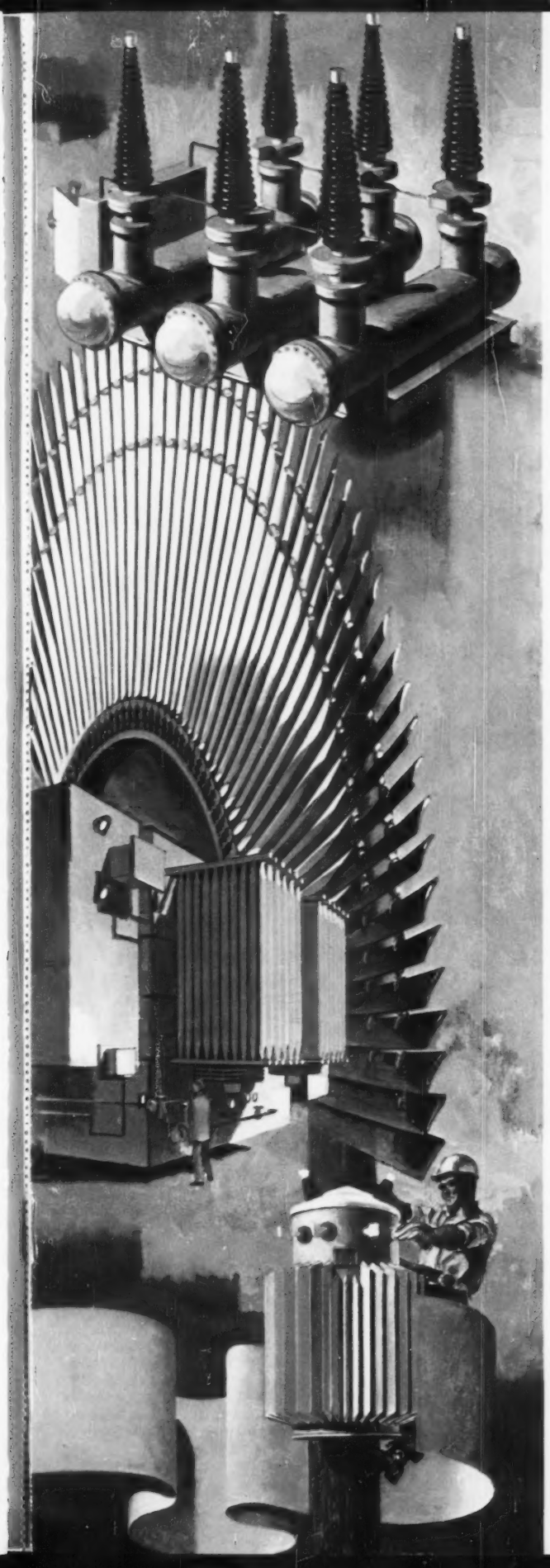
Write today! Tell us what your requirements are...we will be glad to show you how the RS-9 Fourteen can meet them at low cost.

*TYPICAL SYSTEM INSTALLATION

Type RS-9 Fourteen Automatic Oscillograph—complete with initiating mechanism, time recorder and record magazine. (For operation on 125 volts)	$3,330.00
14 Bifilar galvanometers—group 155	1,330.00
1 lamp power unit	270.00
7 RAV (voltage) or 7 RAC (current) shunt resister assemblies	490.00
1 3-phase under voltage starting relay	143.00
1 neutral current starting relay . .	160.00
1 overcurrent starting relay . . .	160.00
1 auxillary network	107.00
	$5,990.00

PRICES NET F.O.B. DENVER, COLORADO

HAMILTON WATCH COMPANY
HATHAWAY INSTRUMENT DIVISION
5800 East Jewel • Denver, Colorado



on the way from WESTINGHOUSE products for your supersystem

Spectacular growth in utility loads in the 1960's and 1970's is certain. Over one and a quarter trillion kilowatt hours is the power market projected for 1969. To produce energy on this scale will require a generating capacity of 295 million kilowatts . . . more than twice today's capacity.

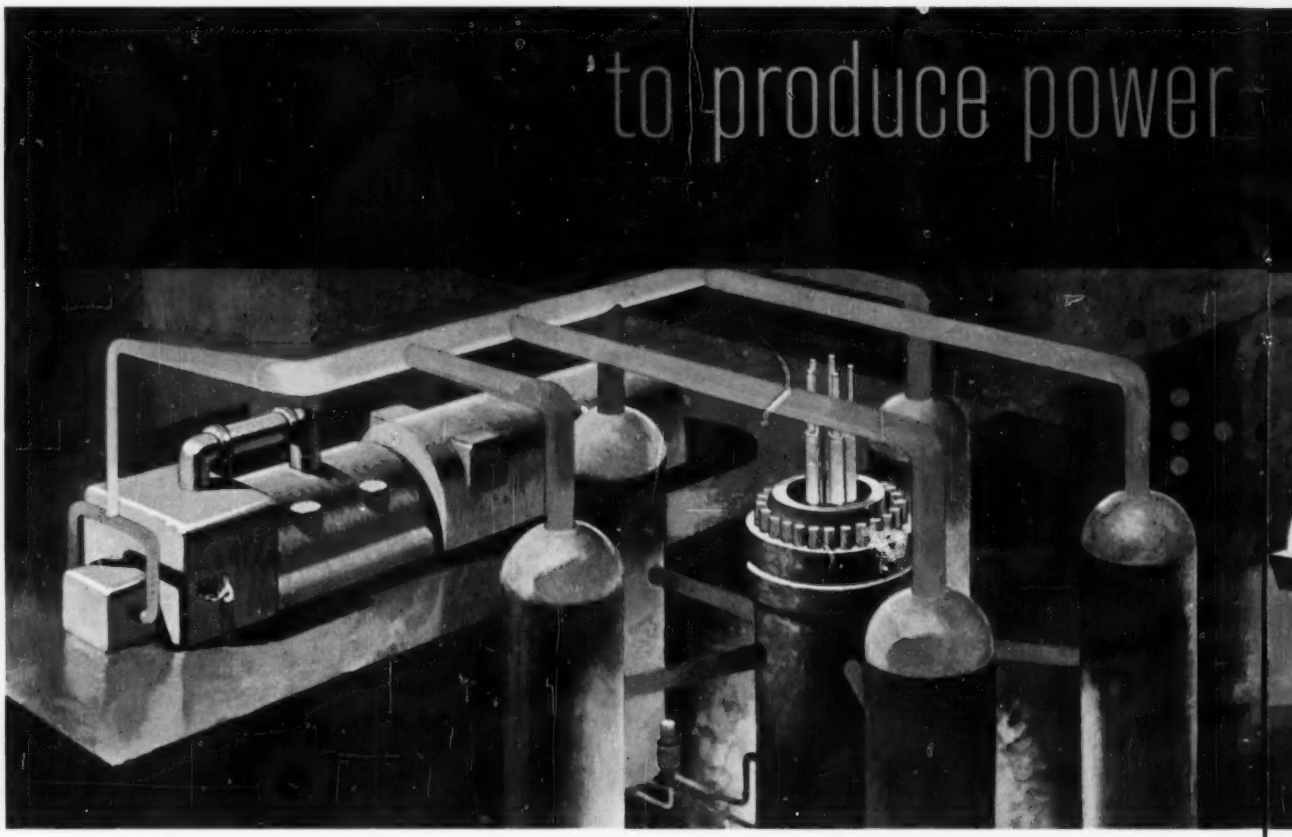
What is the pattern of your future system?

In the era of the superload, the supersystem will emerge . . . complex beyond anything seen or experienced to date. Heavier demands on our fossil fuels will necessitate many nuclear power plants. Your generating stations may be completely automatic. To move bulk power economically, you will transmit at higher voltages. To handle system peaks, you may be sharing capacity to a greater degree than ever with neighboring systems through interconnection. Doubled distribution voltages may be your only answer to meeting residential loads.

Westinghouse can bring you the products you will need to meet these requirements. Westinghouse has built some of these products. For the others, basic design and engineering work has been completed. Read this story on the following seven pages.

WESTINGHOUSE

is ready today to build products



Westinghouse is now ready to build a 330,000-kw nuclear power plant

Westinghouse offers this nuclear generating station for service on your system in 1965. This plant will compare in capacity with the largest fossil fuel plants required to meet present standards of economical generation. Power cost? Competitive with fossil-fueled plants in some areas of the country today.

Through comprehensive evaluation of dozens of possible reactor designs, Westinghouse has concluded that no one nuclear power plant is ideal for all times, or every utility power need. The most promising reactor types are currently under intensive development. For generating stations of the size now being added to utility systems, the pressurized water reactor is the only nuclear plant sufficiently advanced and proved to be offered for immediate construction.

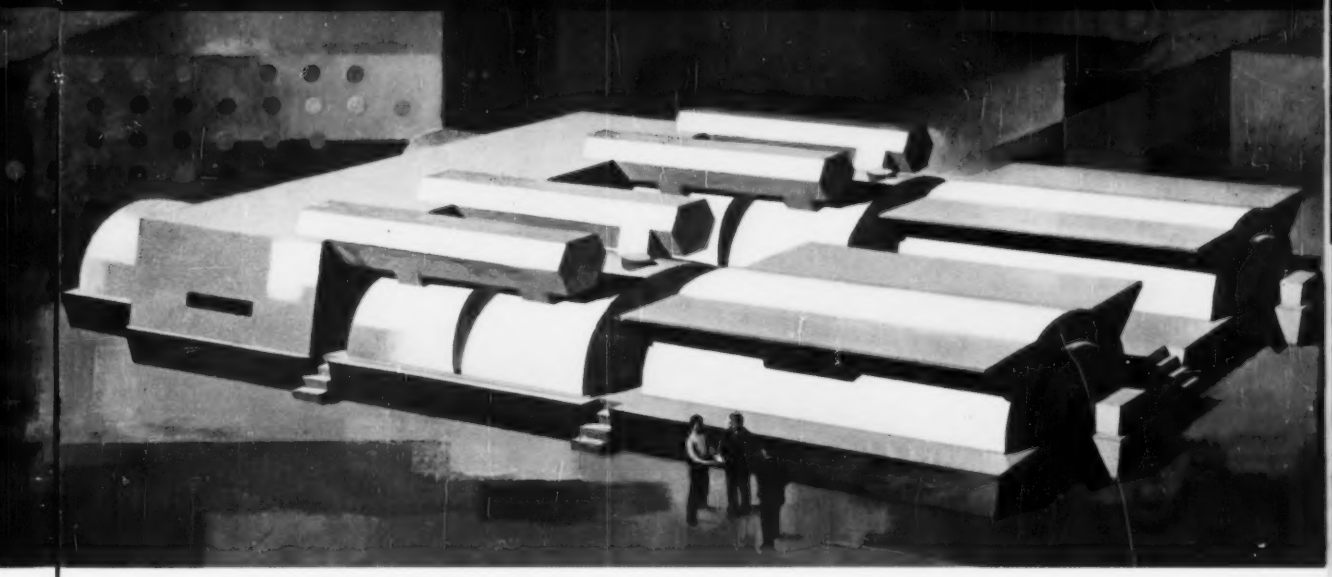
This plant is a result of the $40 million nuclear power investment by Westinghouse to make world-wide power generation from the atom practical, economical.

Westinghouse is ready to build unprecedented 800,000-kw turbine-generator now . . . almost twice the capacity of the world's largest today

From Westinghouse research has come a new 28-in. exhaust end blade capable of 25 percent more power than any that have preceded it. Cross-compounding with four exhausts on each of two 3600-rpm shafts, this blade makes possible an 800,000-kw turbine-generator unit. Here is tomorrow's turbine-generator

s for your future system

Experience to understand total system operation . . . For decades, a special staff of engineers at the Westinghouse Electric Utility Engineering Department has been applying a bold mixture of technical knowledge and imaginative thinking to broad system problems. From long-range studies, basic concepts of power systems of tomorrow are being created.



to supply massive amounts of low-cost, dependable electric power to a growing American economy.

Another turbine-generator of tomorrow is already in production at Westinghouse. The highest pressure, highest temperature turbine ever undertaken is the 1200° F, 5000-psi unit for the Eddystone Plant of the Philadelphia Electric Company. Because temperatures in this range are far beyond the capability of ferritic materials, this turbine uses austenitic alloys. Over-all station heat rate will be about 8100 Btu per kwhr—the most efficient in the world. This machine will produce 10 percent more power from the same amount of fuel than any now in operation.

Efforts to wring more and more power out of a pound of coal do not end with these giants. A combined gas-steam plant is coming. The same combustion source provides steam for the steam turbine and heat for the gas turbine. Result? Higher thermal efficiency.

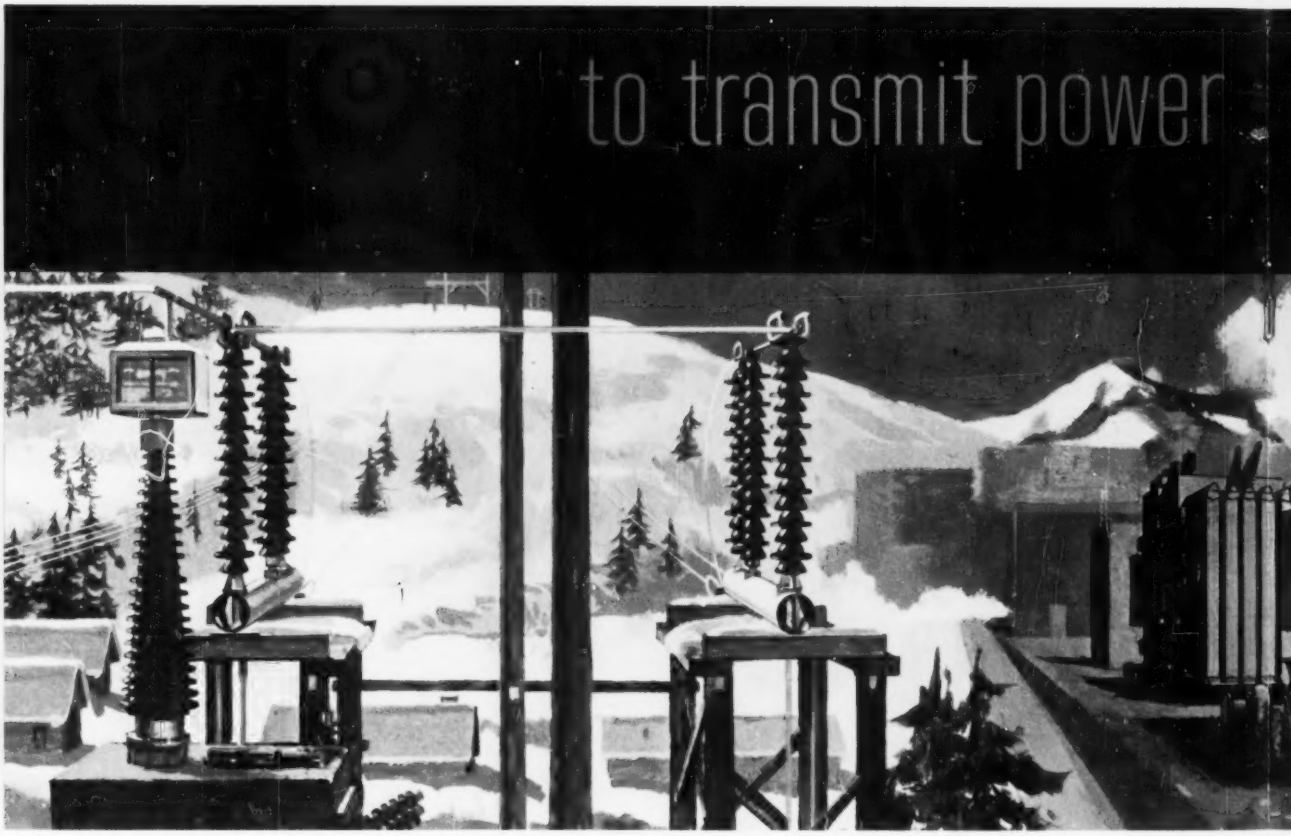
With two outstanding breakthroughs, Thermalastic® insulation and Inner Cooling, Westinghouse generators have kept—even exceeded—the pace of power generation needs. A 384,000-kva generator is being built; even higher ratings are in the offing. Generators can be built now to match any turbine that can be built, any system plan that can be devised.

This generating equipment can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

YOU CAN BE SURE...IF IT'S **Westinghouse**

WESTINGHOUSE

is ready today to build products



Westinghouse is ready now to build power transformers for 690-kv systems

The great hinge on which the design of transformers of the future swings is extra-high voltage. The Tidd project of the American Electric Power Company, begun 13 years ago, proved that EHV transmission at 345 kv, 460 kv and above was practical and dependable. All operating conditions that could be expected were simulated. Today, transformers, power breakers, arresters and disconnect switches operate at extra-high voltages successfully on hundreds of miles of circuits.

Three years ago, a laboratory of rocks and snow, the Rockies, began yielding a wealth of data for design and operation under extremes of weather and high altitudes, furthering EHV studies. Sponsored by the Public Service Company of Colorado at Leadville, Colorado, this broad investigation of corona and radio influence, switching surges, conductor sizes, reduced insulation levels and economics of EHV is continuing.

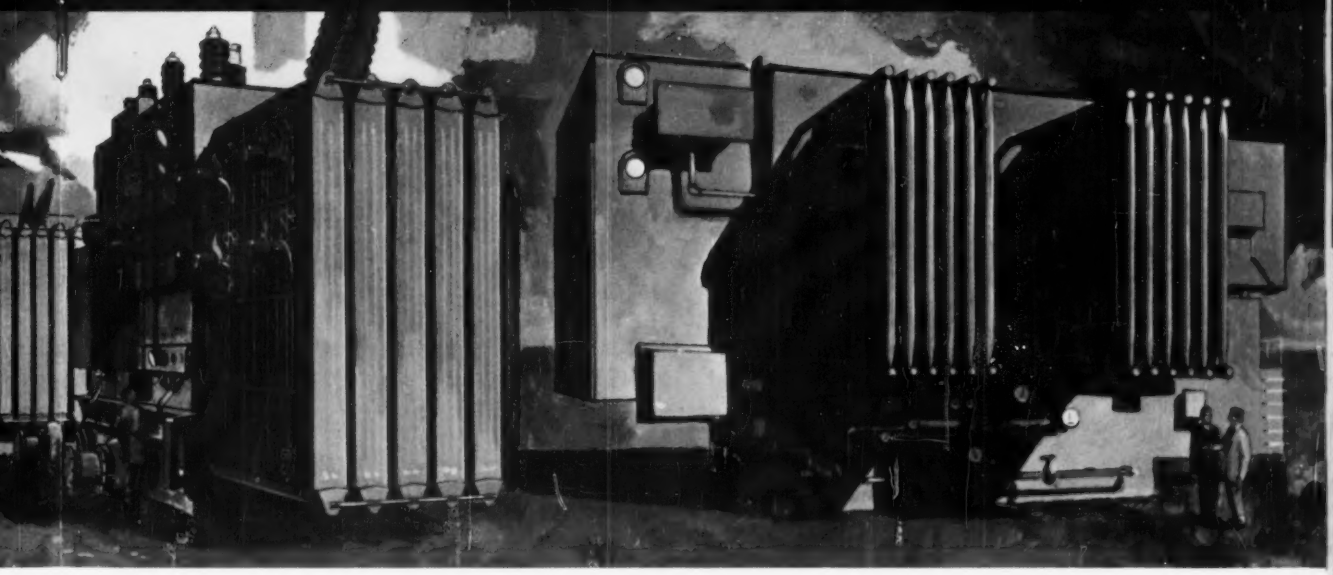
The Tidd and Leadville projects and other studies are the building blocks of EHV knowledge, making possible the design and application of the transmission equipment in your future.

Inner-Cooled transformers . . . reduced size and weight

Inner Cooling makes maximum use of oil as coolant and cellulose material as insulation, drastically reducing core and coil size. The significance of this design lies in two major areas. First, Inner Cooling now enables Westinghouse to build and ship transformers of

s for your future system

Determination and resourcefulness to design the industry's most advanced line of apparatus . . . New Westinghouse products answer problems and objectives confronting the electric utility industry. At 200 research and design centers across Westinghouse, the industry's most concerted and interrelated effort to meet these objectives is continuing.



enormous capacity. The world's first transformer with Inner-Cooled construction was recently installed at New York State Electric & Gas Company, weighing only 3.1 pounds per kva. On higher voltage designs, weight has been brought down to 1 pound per kva.

Second, operating cost per kva is now lower than ever before. Performance has improved, permitting reduction of impedances and losses.

These compelling reasons commend the Inner-Cooled Westinghouse design for the transformer of the future.

Vapor-cooled transformers . . . combine dry-type safety with liquid-filled capacity and insulation level

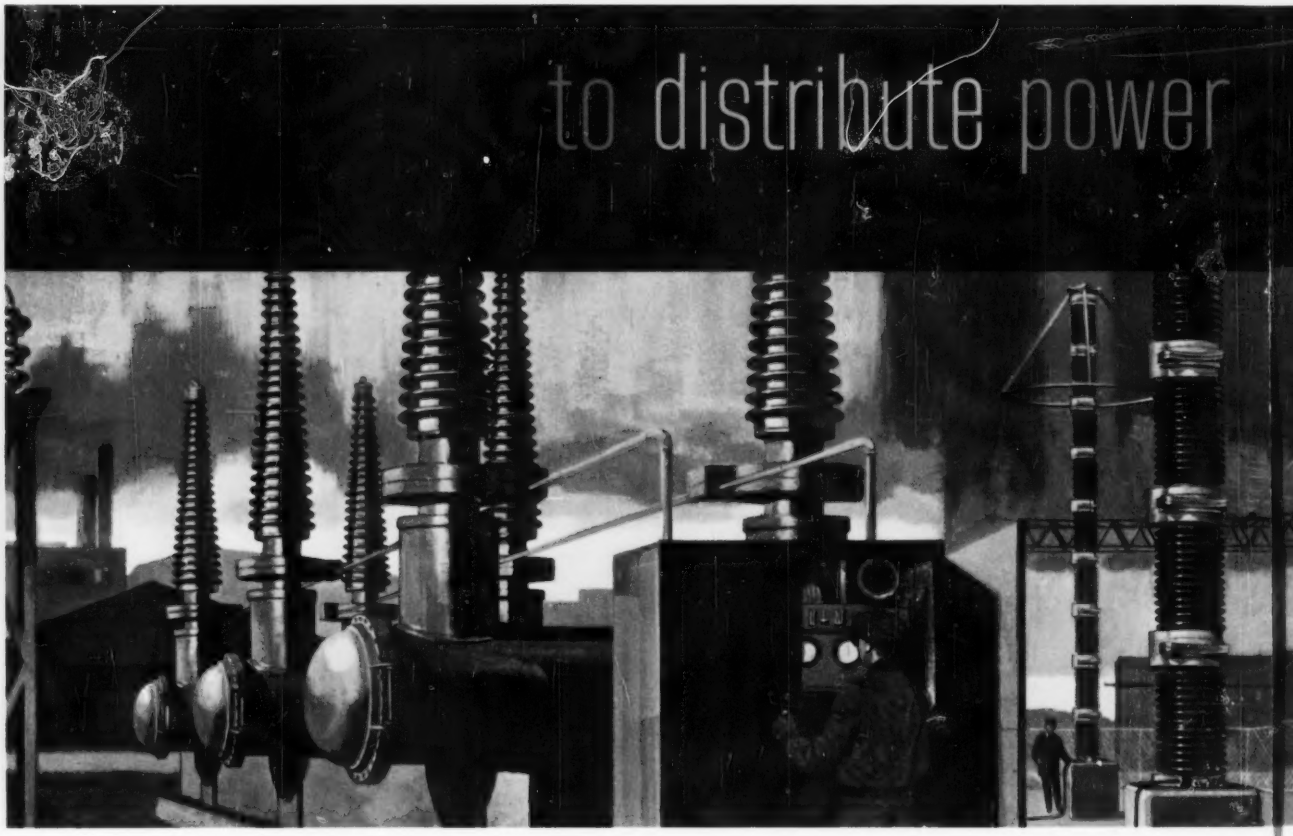
Vapor-cooled, vapor/gas-insulated transformers are another major breakthrough in Westinghouse power transformer design. This technique uses fluorocarbons to transfer heat . . . as a vaporizable liquid for cooling and as a high-dielectric gas to insure proper insulation strength. Two such transformers—the world's first, at Baltimore Gas & Electric Company and Consolidated Edison Company—are now in service and promise to be the ultimate answer in congested areas. They're nontoxic, nonexplosive, fireproof, thermally stable; in brief—they are safer.

This transmission equipment can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

YOU CAN BE SURE...IF IT'S **Westinghouse**

WESTINGHOUSE

is ready today to build products



Westinghouse is ready now to build 690-kv power breakers . . . SF_6 Gas is breakthrough to conquest of the industry's cost-hi-t arc extinguishing problems

Sulfur Hexafluoride--SF_6 Gas—is the interrupting medium for a 230-kv, 15 million-kva power circuit breaker now being built for Pennsylvania Power and Light Company. What are the limits to capacity of the SF_6 breaker principles? There are none.

Capacity is only one measure of the most significant breaker design advance in over 15 years. Safety? SF_6 is inert, nontoxic, odorless, nonflammable; breaker is dead tank construction. Maintenance? Drastically cut; arcs are extinguished without gas deterioration. Weight? Reduced up to 65 percent over comparable oil breaker ratings; foundations can be simplified. Quiet? Comparable to oil breakers; ideally suited for those substations in high load density residential areas.

Here is one more example of how Westinghouse has spent millions in product designs to save utilities tens of millions in future construction and operation.

Westinghouse is ready now to build lightning arresters at and above 690 kv

The idea of a nationwide transmission grid highlights two needs immediately . . . extra-high voltage transmission and standards of reliability never before achieved. EHV will be required to move large blocks of power economically. But, a basic problem in EHV reliability has been lightning outage. Application of a completely new theory of lightning stroke now promises to reduce lightning flashover by three to one. Effects of lightning on different designs of transmission

s for your future system

Capability to produce the industry's most complete line of reliable apparatus . . . With utility industry progress at a dead run, a responsible manufacturer can do nothing less than provide equipment as operationally perfect as manufacturing science can produce. Westinghouse ability to continue to meet this challenge is evidenced by facilities being built and modernized throughout the company at the rate of 70 million dollars a year.

line can now be predicted with far greater accuracy. Increased line reliability must be matched by improved protection of equipment. Westinghouse is ready now to build arresters to meet the obligation of reliable, economical transmission . . . to 690 kv.

You can reduce distribution investment 25% by doubling secondary voltages

Apparatus investment in distribution systems is well over a billion dollars annually. An opportunity to save hundreds of millions of such an amount can scarcely be overlooked.

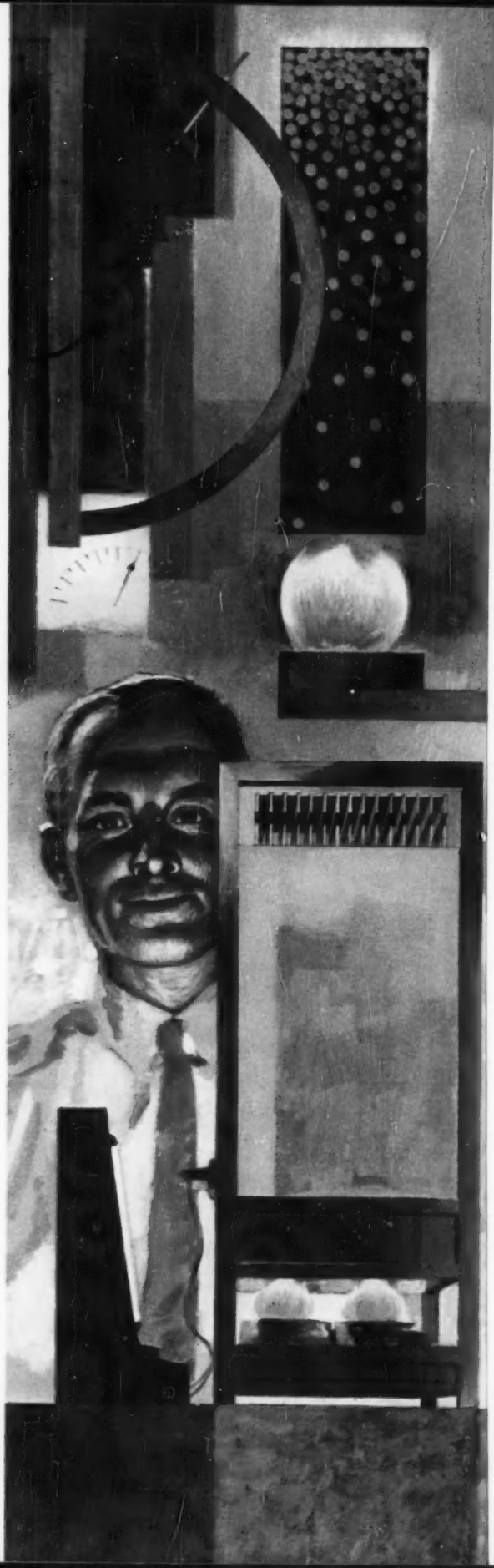
For example, in a high-use residential area, a 37½-kva transformer may serve four homes. In new housing developments, by changing over to 240 480-volt service, one transformer can do the work of four or five. With higher secondary voltages, primary voltages may be raised to 25 kv or even higher. This eliminates present intermediate voltage levels and need for substation transformation.

Average industry installation costs and capitalization rates indicate higher secondary voltage systems will save substantially through the years over present conventional systems.

Westinghouse is ready now to build pole-type transformers at 333 kva for commercial loads.
This equipment of the future can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

YOU CAN BE SURE...IF IT'S **Westinghouse**

This experimental Westinghouse thermoelectric generator produces electric power by the direct conversion of heat into electricity. Work is progressing on this and similar advances—keys to the future beyond the developments discussed on the preceding pages.



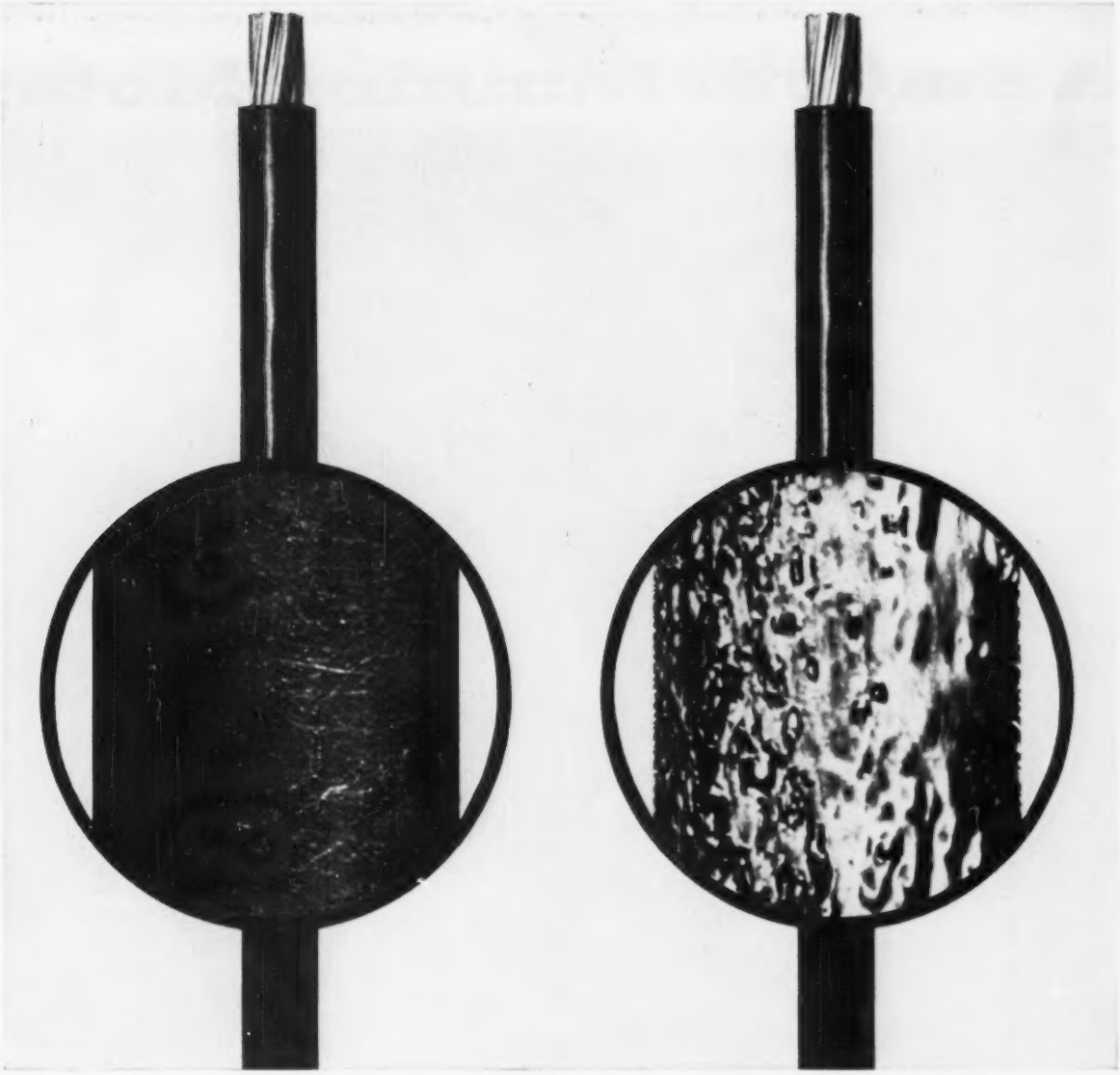
there's time to plan but none to waste

The products shown on the preceding pages will be component parts of the power system of the 1960's . . . your system. The need for these products, so evident today, was discernible many years ago. Westinghouse marshaled foresight, talent and capital to develop them. Westinghouse presents them to you with the conviction that their place on your system should be recognized now, be planned for today.

Get in touch today with your Westinghouse representative. He can bring to bear on your system development program the talent and facilities of all of Westinghouse. CP-1051

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL DESI ARNAZ SHOWS" — CBS TV



QUALITY CONTROL MAKES THE DIFFERENCE IN ALCOA COVERED CONDUCTOR

Most covered conductor looks about the same . . . and, for the first few years, *may* perform about the same. But looks can often be deceiving and sometimes very costly. For the fact is: all covered conductor is not alike. There's very often a big difference . . . and, in Alcoa covered conductor, that big difference is quality control.

Consider the problem of moisture in polyethylene covers, shown in the enlarged illustration above. Though moisture is not absorbed by polyethylene, it will cling to polyethylene if proper manufacturing controls are not observed. Such moisture can actually be trapped in the polyethylene batch as it goes through the extruder . . . causing pin holes, voids, a spongy covering . . . creating weaknesses which contribute to reduced operating life. But in the manufacture of Alcoa covered conductor, this problem never has a chance to occur. Continuous quality control prevents these hidden weaknesses by eliminating their causes.

Alcoa covered conductor undergoes the most exhaustive series of tests in the industry . . . tests before, during and after manufacture to make sure you receive the very best product which can be made by the most modern production methods.

Recognize this big difference of quality control in your installations by specifying Alcoa . . . in neoprene, polyethylene or special coverings. No extra cost, but savings through added reliability and longer life are bound to be substantial. Aluminum Company of America, 2110-G Alcoa Building, Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC-TV

ALCOA ALUMINUM

A look inside an E-M Straight-Up-Ventilated

A Smooth Running Motor

HAND-CRAFTED CONSTRUCTION
by skilled craftsmen is the only way to achieve the smooth motor operation shown in pictures at right, top. Coils are carefully lashed one to the other and to heavy support rings. Bearing brackets are hand tooled for perfect bearing fit.

E-M **ELECTRIC MACHINERY**

Builders of the new pump motor

8300-TPA-2203

Boiler Feed Pump Motor will show you

Doesn't Just Happen...

LISTEN CLOSELY. This running E-M Motor is not dead silent—just remarkably quiet. And when you stand near an E-M Straight-Up-Ventilated Motor, you aren't blasted in the face with hot air. Cooling air goes straight up.

NICKEL-ON-EDGE demonstrates fine balance of operating E-M boiler feed pump motor. Engineers visiting E-M factory learn Straight-Up-Ventilated Motor balance is far superior to usual commercial standards.

Quiet operation, precise balance result from E-M's imaginative engineering, thorough workmanship

The eye-opening boiler feed pump motor performance pictured above isn't confined to the test floor. It lasts for years. And E-M planned it this way because power plant engineers asked for it.

Yes, here is a motor that embodies those design features most wanted by power plant engineers:

1. Locked-in rotational stability that assures a lifetime of smooth operation.

2. Built-in acoustical control that makes the motor as quiet as the pump.

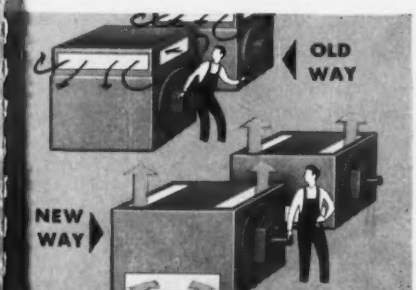
3. Top air discharge that carries ventilating air up and away—no recirculation or cross circulation to affect cooling of motors.

4. Easy access that enables one man to disassemble the motor for routine inspection without a hoist.

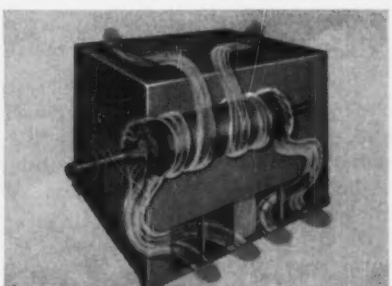
5. A low silhouette that lets you look over the motor to see other personnel and equipment in the pump room.

Your nearby E-M Field Engineer will be glad to give you complete details of E-M's finer motor construction. Call him, and write the factory for your free copy of the Straight-Up-Ventilated Motor Brochure No. 1134W.

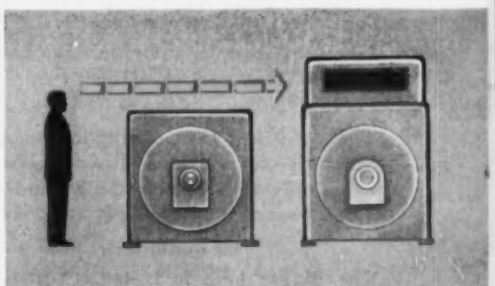
MANY BIG DIFFERENCES MAKE THE DIFFERENCE



STRAIGHT-UP-VENTILATION



AIR-FLOW ACOUSTICAL CONTROL

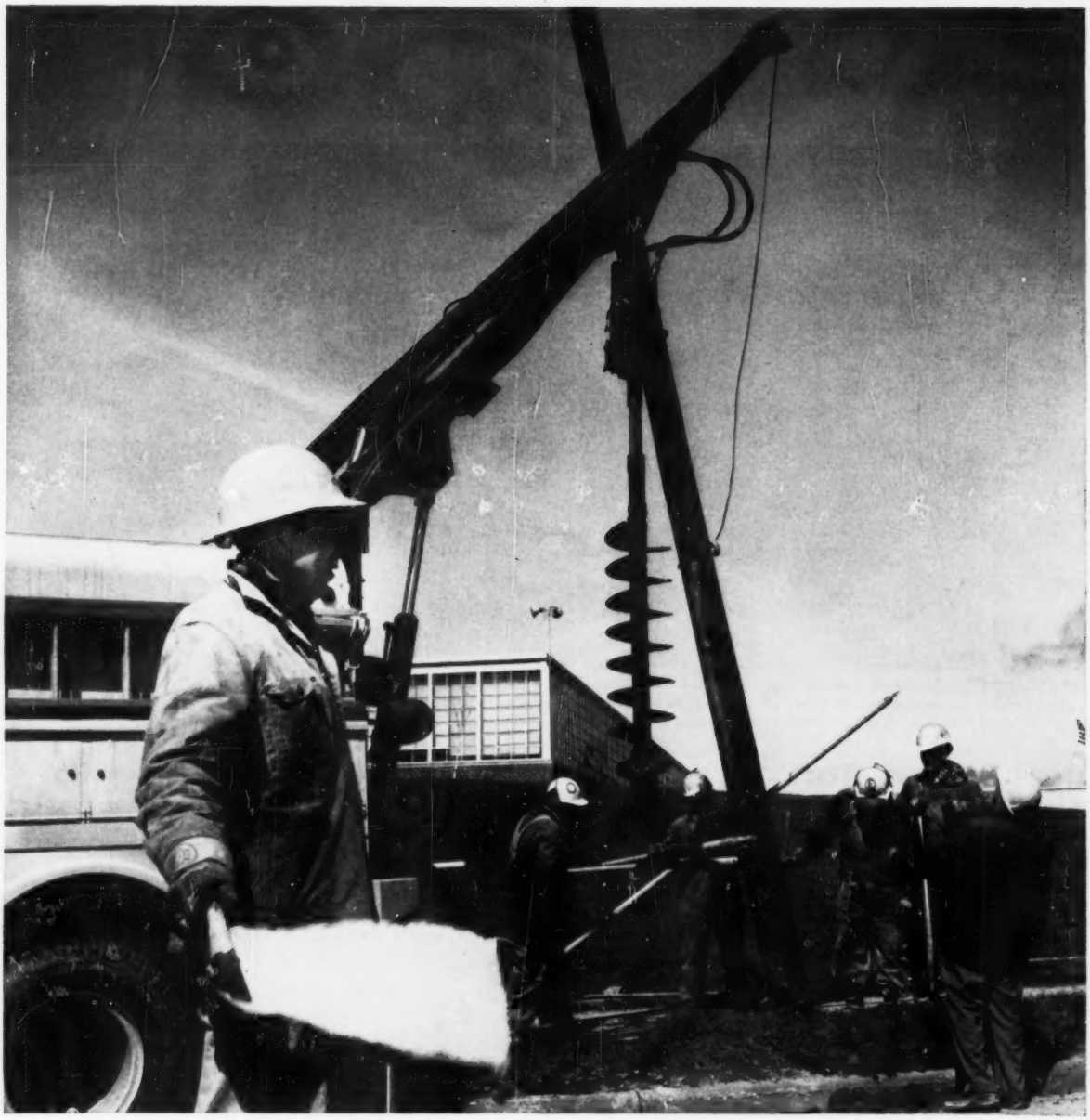


MINIMUM HEIGHT—MAXIMUM VISIBILITY

MFG. COMPANY MINNEAPOLIS 13, MINNESOTA

that performs as well on the job as on the test stand

1134P.



more oomph

Like some people, some derricks have a little extra oomph. This derrick—Holan's Series 6800 has it . . . especially in the lower operating ranges.

The 6800 has extra strength because of extra lift cylinders—four instead of two. It lifts 2,000 pounds when only 5½ feet from the ground . . . body-loads 4,000 pounds. Capacity is 8,000 pounds.

More digger oomph, too

The digger here is Holan's 3-speed Series 5400. Maximum torque is 8,400 foot-pounds—tops by far among derrick-suspended diggers. With the power of the derrick and digger combined, you could bore through just about anything.

If you are in the market for power equipment with that extra oomph, get in touch with a Holan Field Representative.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio
Plants in Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

Holan

Subsidiary of THE OHIO BRASS COMPANY

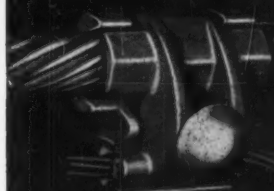
HOLAN

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2



PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4
6—1 0 A R Cu. 8—1 0

BLACKBURN
COPPER TO
ALUMINUM
FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

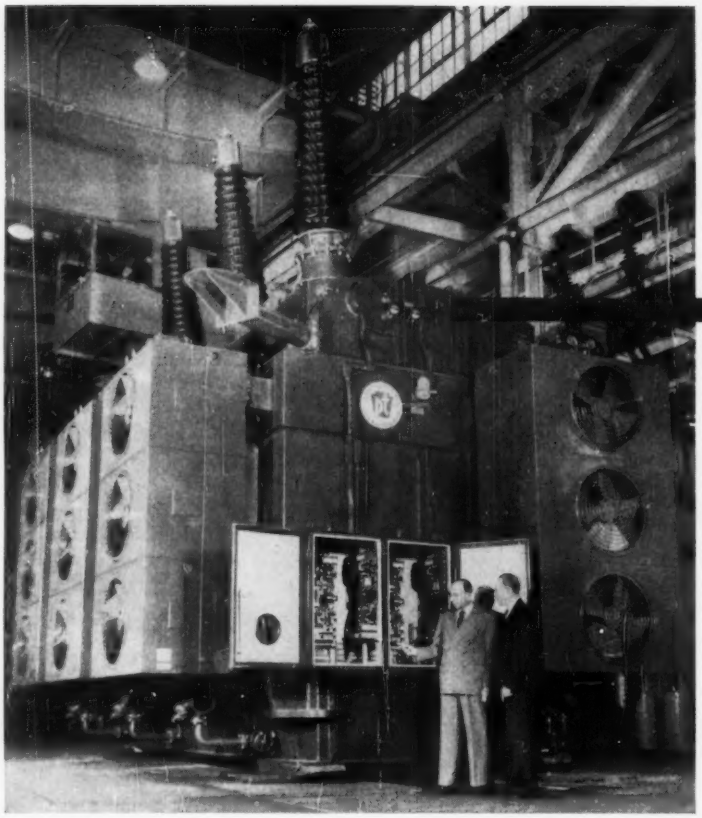
Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

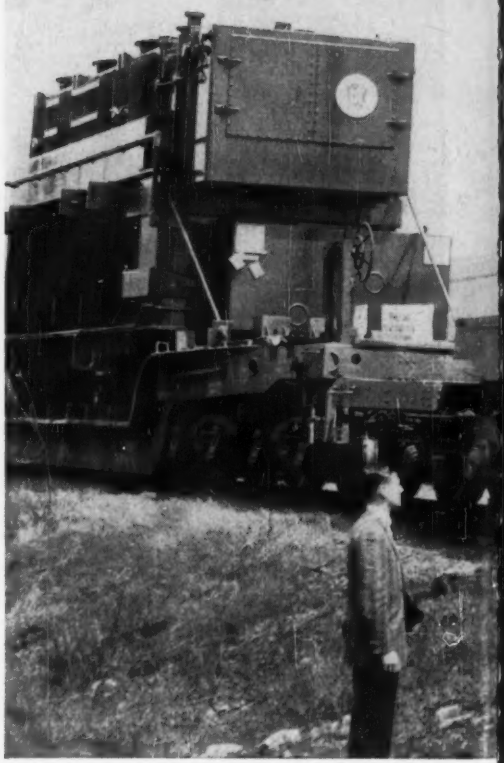
JASPER BLACKBURN CORPORATION

1525 WOODSON RD., ST. LOUIS 14, MO.
WYdown 3-9430



315,

...OUR BIGGEST TO DATE



We at Pennsylvania Transformer Division, McGraw-Edison Company want you to be aware of our ability to meet the largest power transformer requirements. Our advertising frequently calls attention to this ability by picturing plant facilities, just-completed large power transformers, and installations of our transformers at generating stations.

This time our production department (bless 'em!) has helped dramatize our story by completing two large Contour Design shell-form transformers—totaling 465,000 kva—within a few hours of each other. While this sort of close scheduling is not exactly routine, it is noteworthy that both transformers went through the plant on a "work-as-usual" basis with no overcrowding or taxing of facilities.

The transformer on the righthand car—the largest Pennsylvania has ever made from the standpoint of capacity—is a 315,000-kva main step-up generating station transformer for a midwestern utility. High voltage: 230,000 GrdY/132,800 volts. Low voltage: 17,200 △ volts.

The transformer on the lefthand car—destined for an eastern utility—is a 150,000-kva load tapchanging transformer. High voltage: 220,000 GrdY/127,000 volts. Low voltage: 69,000 GrdY/39,800 volts, with LTC equipment for plus or minus ten percent regulation in 32 steps of ⅝% each. Tertiary voltage: 13,800 △ volts.

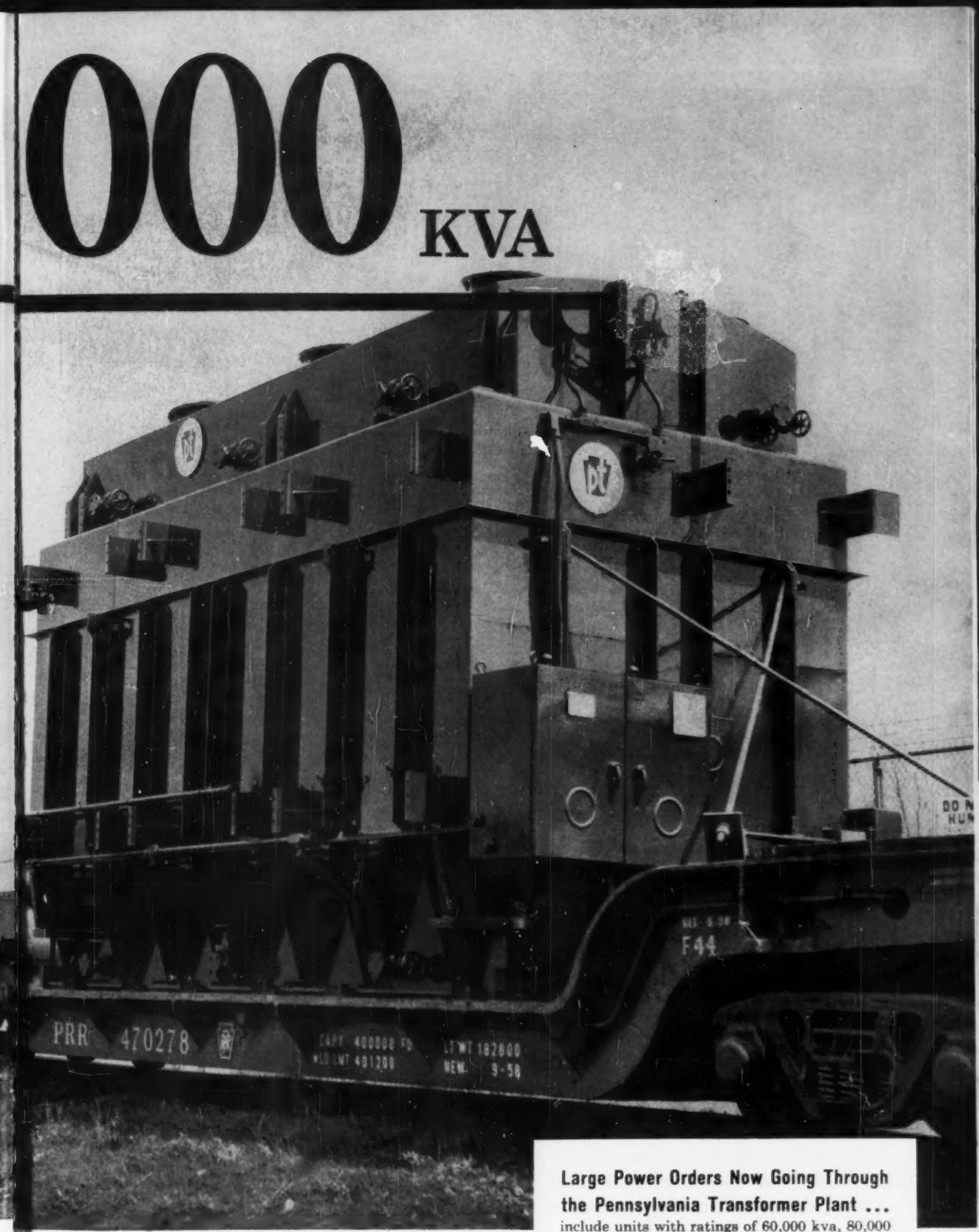
We'd like to quote on *your* next power transformer needs. Large or small . . . with or without LTC . . . shell-form or core-form, we have the facilities and the experience to meet your most exacting requirements. Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA TRANSFORMERS pt

PENNSYLVANIA POWER T

000 KVA



Large Power Orders Now Going Through the Pennsylvania Transformer Plant ...

include units with ratings of 60,000 kva, 80,000 kva, 100,000 kva and 260,000 kva. All are scheduled for completion within approximately one month. In addition, Pennsylvania is preparing to build a 460,000-volt transformer for at eastern utility company's forthcoming experimental transmission lines.

TRANSFORMERS

Painted—1951
with DECOSTEEL PAINT

Inspected—1959

Practically no deterioration
Repainting unnecessary

SAVE UP TO 50% ON TRANSMISSION TOWER AND SUBSTATION STRUCTURE PAINTING COSTS

DECOSTEEL (STAINLESS STEEL) PAINT—a laboratory and field tested coating—protects metal with an extremely durable, long lasting brilliant finish that defies weather, smoke and corrosive fumes. Its conservative life expectancy of at least 12 years will result in substantial savings. The additional years of service will reduce labor expenditures that represent from 80 to 90% of total painting costs. This is a paramount consideration in figuring maintenance costs on transmission towers and substation structures.

Check these superior qualities:

- Outstanding durability, displaying practically no wear.
- Excellent hiding power, brushing properties and package stability.
- Moderate chalking characteristic.
- Ultra smooth surface which sheds dirt, dust and other foreign substances, affording the ultimate in appearance.
- Conservative life expectancy of at least 12 years.

The advantages of multi-pigment stainless steel paint are attained only when it is applied over properly primed surfaces. Write to us direct for information regarding proper priming coat to use with DECOSTEEL (STAINLESS STEEL) FINISH COAT.

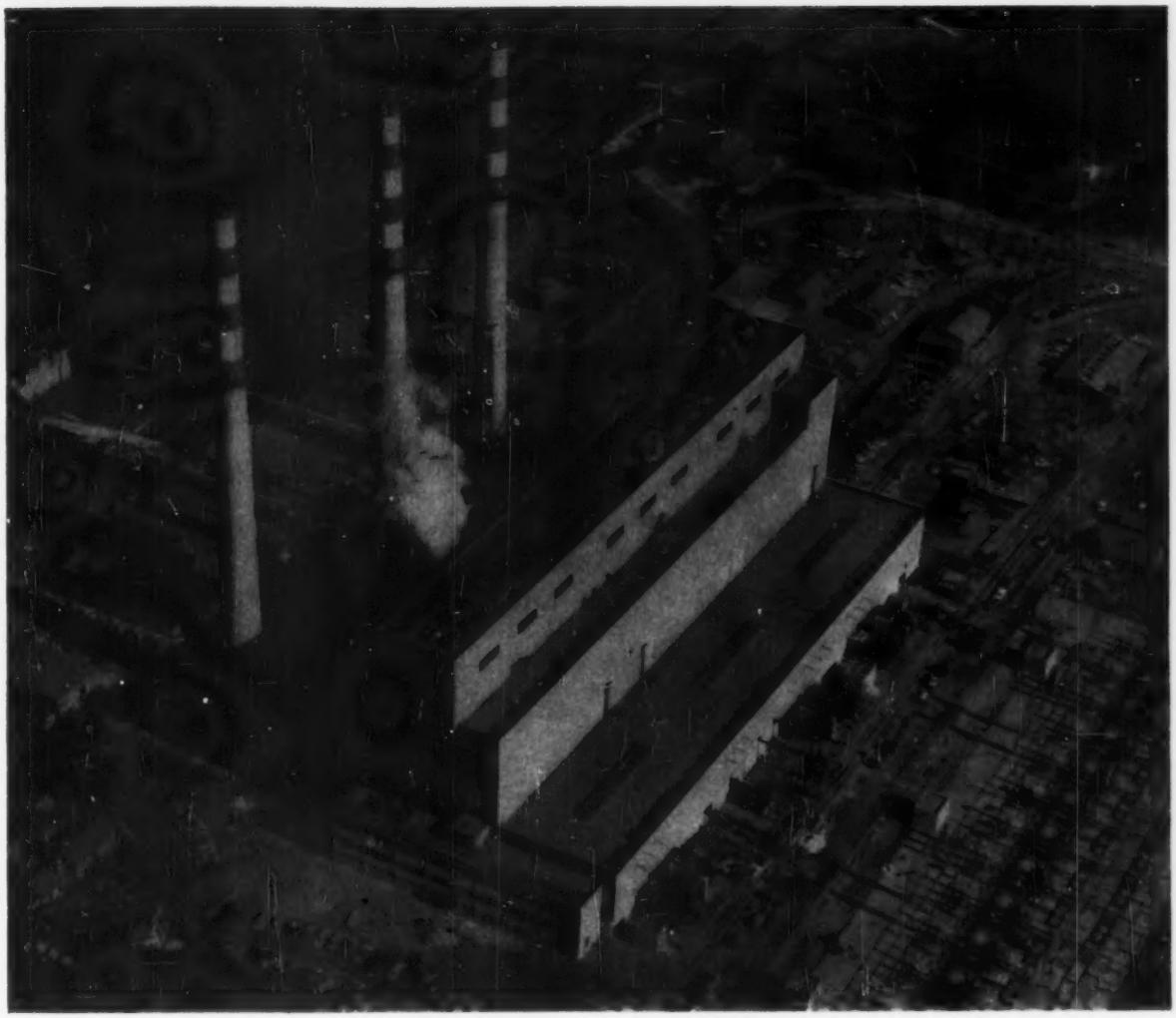
An extensive eight year field test conducted on numerous transmission towers exposed to corrosive atmosphere by a leading utility company has dramatically demonstrated the outstanding durability of Debevoise Decosteel Paint. Towers painted with Decosteel (Stainless Steel) Paint still look as good as the day paint was applied, while those with standard tower paint show definite signs of failure.

THE DEBEVOISE COMPANY

ESTABLISHED 1911

Specialists in coatings for the Public Utility Industry

74 Twentieth Street, Brooklyn 32, New York



New Electric Generating Station for Memphis Equipped with Phelps Dodge Condenser Tubes!

The new Thos. H. Allen Electric Generating Station of the Memphis Light, Gas & Water Division, City of Memphis, Tenn., is designed to answer the need for increased electric power in Memphis and surrounding Shelby County. This mammoth plant, designed by Burns and Roe, Inc., and constructed under their supervision, has three hydrogen-cooled turbine generators and three multiple-pass condensers, with a new capability of 812,500 kilowatts.

Within the condensers are more than 298 miles of Phelps Dodge Admiralty condenser tubes, weighing about a million pounds. These 30-foot-long tubes help each unit condense steam from the generators at the rate of over one million pounds per hour. Each condenser has a heat transfer-rate of 980 BTU per pound of condensed steam.

Phelps Dodge condenser tubes are known for lasting quality and expert workmanship in industries using heat transfer equipment. This reputation has made Phelps Dodge a leading manufacturer of copper and copper-alloy tubes for the fabricators of condensers and heat exchangers.

PHELPS DODGE COPPER PRODUCTS

CORPORATION

300 Park Avenue, New York 22, N.Y.

Are you paying for not having full-load, full-voltage switching on your distribution feeders?

If you are opening your distribution feeders with rotating-insulator disconnects—of the two-insulator side-break or three-insulator vertical-break type—you are already *paying enough* to get full-load switching at full-line voltage (as distinguished from loop sectionalizing . . . load splitting . . . where the voltage across the switch is low).

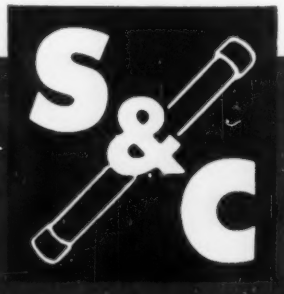
By using S & C's Side-Break Alduti Load Interrupters, you can have arc-free 600-ampere load switching through 14.4 kv at the same price, or at a lower price than you are now paying. Ordinary disconnects can, at best, only partially handle loop sectionalizing (that is, switching currents in parallel or loop circuits), let alone properly handle full-load, full-voltage switching.

Why do you need this switching capability? There are two important reasons:

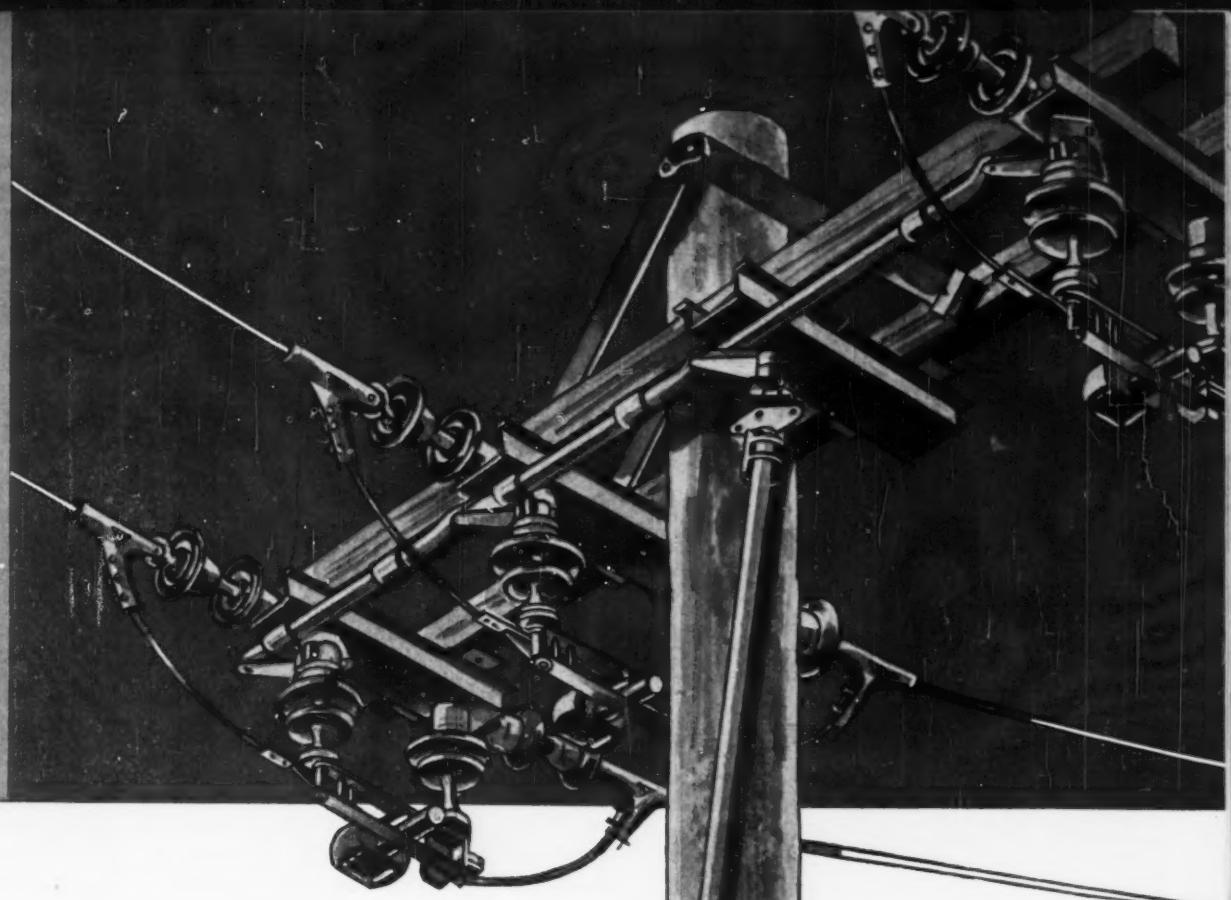
First—Emergency situations (wires down, etc.) demand quick action—dumping the load. And usually there is no time to set up communications for complicated breaker and switch sequencing.

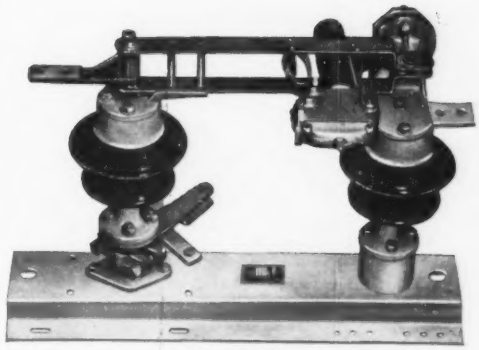
Second—There's always the possibility of switching error, with the result that a loaded circuit may be inadvertently dumped.

If on the other hand, you are using budget-priced rocking or swiveling insulator disconnects, you may be saving on initial costs, but you are still losing the load switching capability you need. With these disconnects, or with rotating insulator disconnects, you will be paying *with trouble*—when you try to drop full load or when you try to open a heavily loaded loop.



LOAD INTERRUPTERS





Closeup view of S & C Alduti Load Interrupter (side-break style), 14.4 kv rating. May be mounted vertical, upright, or inverted.

For full information about the S & C Alduti (side-break style) and other S & C Load Interrupters, write for Catalog Section 760, S & C Electric Company, 4421 Ravenswood Ave., Chicago 40, Illinois. In Canada: S & C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.

S&C

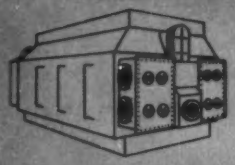
Specialists in High-Voltage Circuit Interruption

Since 1910

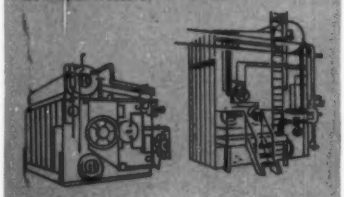
Load Interrupters
LOADBUSTER®
Disconnects
Cutouts
Fuse Links
Power Fuses
Metalclad Switchgear

Power Plant Products

HEAT ENGINEERED BY FW

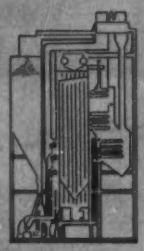


CONDENSERS and HEATERS—Condensers custom designed for individual plant requirements. All-welded high and low pressure feedwater heaters.



PACKAGED and FIELD-ERECTED BOILERS—Compact, economical, standardized units in capacities from 10,000 to 450,000 lb/hr oil, gas or pulverized coal fired.

LARGE STEAM GENERATORS—Designed to meet all requirements for Central Station or Industrial power plants, in single- or twin-furnace designs, with or without reheat or dual circulation.



COOLING TOWERS—Induced draft counter flow towers of all-redwood construction for maximum dependability and long service.

NUCLEAR COMPONENTS—Heat exchangers, steam generators, pressurizers, reactor vessels, separately-fired superheaters for stationary and marine power plants.

PULVERIZED FUEL SYSTEMS—Completely engineered systems utilizing FW ball mill or MB planetary roll and table pulverizers.

HEAT ENGINEERING

SIMPLIFIES LAYOUT and

WITH NEW SINGLE-PASS,

Compact shells use economical short tubes, eliminate two waterboxes, simplify valving. Balanced back pressure and built-in backwashing system offer further advantages for Alabama Power Company's Barry Steam Plant, Unit No. 3.

Problem: Alabama Power Company and Southern Services, Inc., Engineers, specified that the dual exhausts of the 225,000 kw turbine be handled with condenser tubes at right angles to the turbine shafts —in the tight confines of a plant extension for Barry Steam Plant, Unit No. 3.

Solution: Heat Engineering by Foster Wheeler

By application of the established principles of Foster Wheeler condenser design, a most economical arrangement for a twin bottom-exhaust turbo-generator set with tubes at right angles to the turbine shafts was provided. It features short tube lengths, complete backwashing and a minimum number of waterboxes for a twin-shell design.

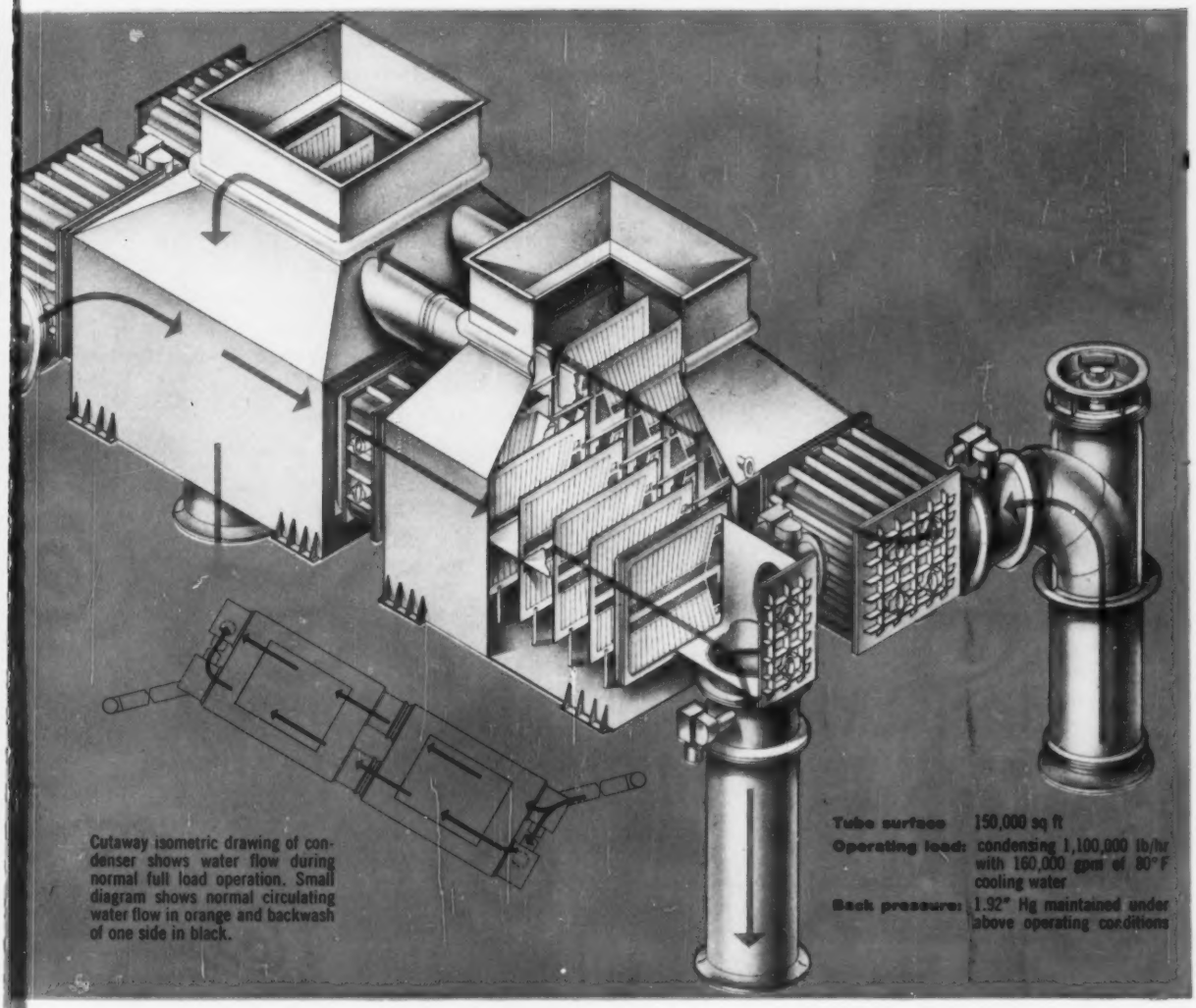
Backwashing of the tube sheets is obtained with only six valves, two of which are the normal circulating pump shut-off valves. This valving arrangement also allows the complete condenser to be operated at light loads with only one circulating pump.

In design advances such as this, you see Heat Engineering at work. This is the concept you can expect—combining new and original ideas with proved engineering principles—when Foster Wheeler serves you. *Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, New York.*

BY FOSTER WHEELER

REDUCES CONDENSER COSTS

COUNTER-FLOW DESIGN



Cutaway isometric drawing of condenser shows water flow during normal full load operation. Small diagram shows normal circulating water flow in orange and backwash of one side in black.

Tube surface 150,000 sq ft

Operating load: condensing 1,100,000 lb/hr with 160,000 gpm of 80° F cooling water

Back pressure: 1.92" Hg maintained under above operating conditions

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

Another call for Collyer...

COLLYER CONTROL CABLES

for the biggest sub ever built!

The Roving Eyes Of The Navy keep constant watch for possible enemy attack over, on, or under the sea. Latest addition to the Navy's growing chain of mobile radar warning stations is the USS TRITON, the world's largest submarine.

Two Nuclear Reactors powering the TRITON use Collyer Cables for vital control functions. These special cables involve new cable materials and new construction techniques. Collyer's engineering, research, and production facilities were utilized on this project as they were on previous nuclear submarine projects.

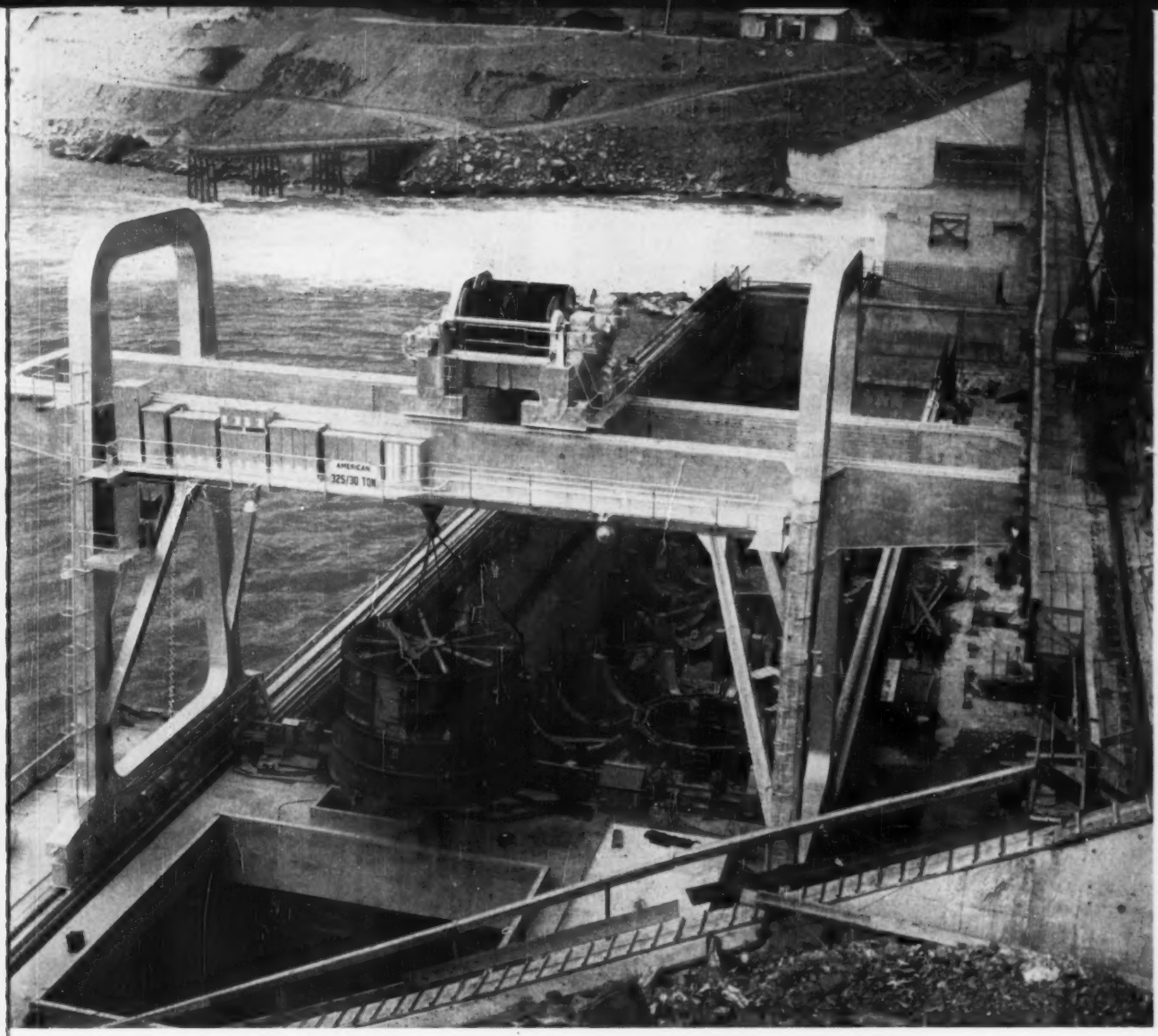
COLLYER cable know-how and manufacturing skill is available to *you*. More and more engineers are calling on Collyer for quality cable construction and maximum cable serviceability. Let us quote your specific requirements. **Collyer Insulated Wire Co., 247 Roosevelt Avenue, Pawtucket, Rhode Island.**

USS TRITON Nuclear-Powered Radar Picket Submarine — General Dynamics Corporation, Electric Boat Division, Builder

Collyer

LIVE BETTER ELECTRICALLY

- Interlocked Armor Cables
- Silicone Insulated Cables
- Portable Power Cables
- High Voltage Rubber and Varnished Cambric
- Insulated Power Cables



AMERICAN 325-TON GANTRY CRANE SERVES NOXON RAPIDS POWERHOUSE

This 325-ton American Powerhouse Gantry Crane is installed at Noxon Rapids Dam in Montana for the Washington Water Power Company. One of the largest powerhouse cranes of its type, it spans 73 feet . . . has main girders 111 feet long. Specified and purchased by Ebasco Services Inc., of New York, consulting engineers on the project, the American crane provides ample capacity for all present and anticipated powerhouse service at Noxon Rapids.

Unusual and specialized lifting and materials handling devices are custom designed, manufactured and installed by American Hoist Pacific Co. whose engineers have years of experience in this field. These qualified men are available for planning consultation at your request . . . you can rely on their assistance throughout the job—from drawing board to installation.

AMERICAN HOIST Pacific Company

4975 Third Avenue South Seattle 4, Washington

Wholly Owned Subsidiary of American Hoist & Derrick Company

ALLIS-CHALMERS modern line for '59

Smaller, lighter three-phase transformers

CUT CHANGEOUT COSTS

Greater Capacity on Existing Poles

You save money when load demands require capacity boosting by using Allis-Chalmers three-phase transformers. In most cases, your present poles are more than adequate when you change out with this new smaller, lighter three-phase transformer. In the Allis-Chalmers redesign program spanning all sizes, weight reductions average 25% — height 13 inches. Typical is the new 150-kva unit that actually weighs *300 pounds less* than an old 112½-kva transformer. Reduced weight and size result in improved handling convenience and save hours of installation time.

Operating economies, too

Curvacore design shrinks transformer size and cuts system operating costs. The effective use of preferred oriented steel results in a compact core with low losses . . . low exciting current. Get the complete story. See your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-1033-E

Curvacore is an Allis-Chalmers trademark.

Editorial Comment

JULY 6, 1959

Are Utility Inventories Adequate?

Utility inventories reportedly are near rock bottom—reflecting major cuts from the 1954-57 highs. Much of the trimming can be attributed to good business practice. Some were in line with cost control measures set off by the 1957-58 recession.

There is a real danger stocks may have been reduced below the adequacy level. Several developments during the first half of this year now point to the need for a close review of inventories to make sure they are sufficient for the months ahead.

First, business recovery has boomed along even faster than the optimists had expected. This has brought increases in weekly power output of 11 to 13% above the same weeks last year, making up for 1958's retarded growth. The boom also has triggered a rise in industrial capital spending and sustained new housing starts at a high rate. Neither of these factors has had time to have much effect on power production.

However, the impact soon will be felt by the utilities. The proportion of capital spending going into modernization is up sharply to 65% of the total. This spells automation—and big boosts in electrical loads. At the same time, the six to twelve month lag before the recent acceleration in housing starts is translated into higher residential sales is almost over. Coupled with a sizable increase in appliance sales, this assures that the important residential area shortly will be contributing to further boosts in utility loads.

Material and equipment to connect and serve new and growing loads must be provided at the right time and place. Crisis buying can be expensive. A prolonged hot spell could trigger a wave of demands on supplier stocks which now backstop utility inventories to some extent.

Each operating company knows its own story. But a close look at inventory levels, in light of the changing economic picture, certainly seems in order.

High School Counselors Must Be Sold

Engineering school enrollments were down last year and may continue down. An Engineers Joint Council study shows a major cause is poor counseling of prospective engineer students. Obvious prescription is effective public relations at the counselor level.

This enrollment trend, superimposed on utility problems of getting and holding qualified graduates, could cause great discomfiture. We suggest, as we have before, that utilities meet the problem before it hits them, and direct their efforts to pre-selling engineering to high-school counselors.

Investors Examine

Hospitality and dignified arrangements impress visitors who tour industrial plants in areas of the Southern Co

To make such trips productive they suggest fairly small groups and brief junkets at an interval of every five years

SEAFARING DAYS of former Navy officer Ernest J. Kocsis are relived on June cruise around Mobile Bay. He is with Morgan Guaranty Trust Co of New York

Money spent on a junket for visiting investors can bring a good return to utility companies.

This view was reinforced last month by a four-day trip sponsored by the Southern Co. Thirty-eight institutional investment executives took part. The guest list read like a Who's Who in American Finance. The investors represented five-million shares of Southern Co stock—almost 25% of the total outstanding.

The tour by-passed the usual steam and hydro installations. Instead, the visitors traveled by airplane, bus, and yacht to meet Southern Co's industrial customers in the Southeast, plus governmental officials and industrial-development men.

Sponsor Sees 4-Fold Benefits

The benefits?

- Investors saw at close range why Southern Co subsidiaries are expanding rapidly to meet needs of new industries flocking to the Southeast.
- Investors spent three days in close contact with Southern Co officials, asking questions about company management and future plans.
- The utility's officials believe the guests will spread the word about the booming industrial South, as well as about Southern Co. This, Southern Co men say, will make past successes breed future success.
- A hidden benefit was local public relations. Newspapers in several cities featured stories on the tour. A Mobile newspaper front-paged three pictures showing the touring investors and their utility hosts talking with Alabama officials.

This was the third investors' visit sponsored by Southern Co.

The first, in July of 1949, was a week-long bus tour of the holding company's installations.

Again in 1952, Southern Co invited investment men to take a look. This time, the junket was held in conjunction with dedication of a 200,000-kw steam plant near Newnan, Ga. After the dedication, the investors returned to Atlanta by bus, then boarded an airplane for birds-eye views of plants in Georgia, Alabama, and Mississippi. Total time on tour: four days.

Last month's tour began with a kickoff luncheon at an Atlanta country club.

During the luncheon, M. W. Leahy, of Thomson & McKinnon, New York, had this to say about investor field trips:

"I could learn all the facts and figures at my desk in New York. But there's no substitute for getting down here to meet Southern Co officials, and having a first-hand look at the industrial Southeast."

Short Trips Best

Asked how long a trip he prefers, Leahy said, "Four days is just about right for a visit to a company of this size. But for a single utility, I think the trip should be much shorter.

"Anyway, where a small new company is concerned, I think its officers should come to the investment people first—meet us, present the facts and plans. Then, after we get some background, we investors can come down for a closer look."

Asked how the June tour-schedule looked to him, Leahy said, "This is the first utility visit I've ever made. But it is one of the best-planned tours I've ever been on in any industry.

"I like the quality and dignity of the arrangements. A recent tour I made to a manufacturing company didn't have this dignity. I suppose a utility is more interested in institutional investors than in speculators. That may have something to do with the overall air of dignity Southern Co has created for us."

Standing nearby on the country club terrace was James E. Breen, of Halsey, Stuart & Co Inc.

Behind-the-Scenes View Helps

Breen said, "I think Southern Co is taking an excellent approach—showing us the industry behind the power plants. I'm interested in learning of the users of electricity, and how they are growing.

"We have all the figures on the Southeastern power business. But now we're getting a chance to see those figures come alive."

Breen said he was impressed by Atlanta's industrial parks, seen on a short morning bus tour.

Asked how many guests make for a comfortable sojourn, Breen said, "I've seen groups of 100 on trips such as this. That's too large. We investors are here to make contact with the company's manage-

the South

ment. With the number of Southern Co officials present, I think our group of 38 investors is just about right. In a four-day period, we should have ample opportunity to get a good picture of the company's operations."

Are utilities sponsoring more visits today than in years past?

"I've noticed a definite increase in such public relations activities as this by all industries. And the power companies are as much on the ball as any segment of industry," Breen replied.

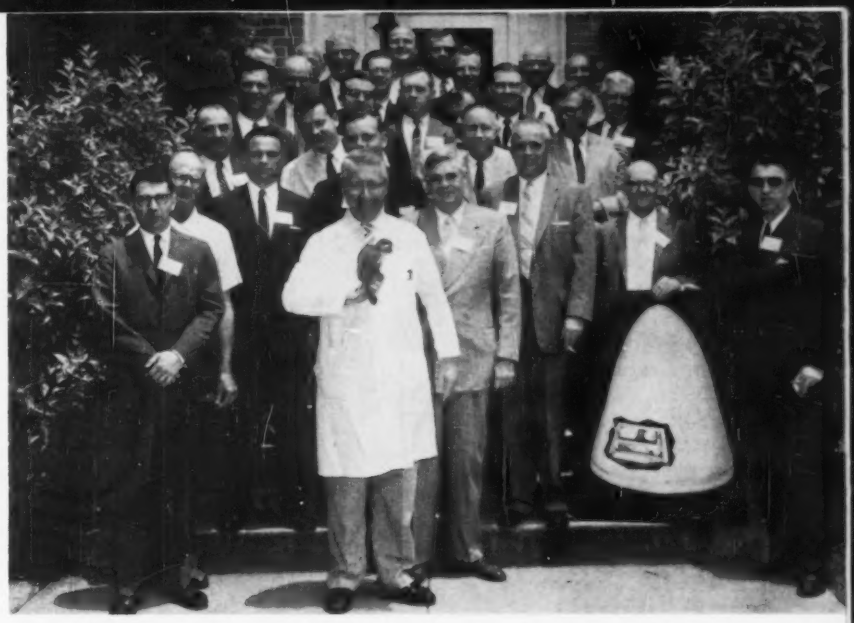
Frank P. Glass of the Chemical Corn Exchange Bank in New York said he is no stranger to utility junkets.

"Last October," said Glass, "I was a guest of Long Island Lighting Co. We left Manhattan by helicopter, went out over Long Island, and saw the industry, the LILCO plants, and the room reserved for utility expansion."

Glass likes to talk with three types of people on a junket: "Representatives of the host company; area development people; and also, I like to talk shop with my colleagues in the area's investment banks."

How often should a utility invite investors to a tour?

"Maybe every five years," Glass said. "Some have tours every nine or ten years. That's not quite often enough to keep me in touch."



SPACE MONKEY, Baker, was sidelight of side trip to Pensacola Naval Air Station, a Gulf Power Co customer. Visitors felt group of 38 men was ideal number

After the opening luncheon, Southern Co Pres Harllee Branch, Jr, told the investors about his company's investment program.

"During the next three years," said Branch, "we expect to invest $514 million in new service facilities."

Next, James Crist, Southern Co vice president, and Southern Electric Generating Co president, showed color slides of the SEGCO construction. The steam plant's initial capacity, Crist told the investors, will be 1-million kw. And the nearby coal mines will produce 2½-million tons a year (about one-fifth of Alabama's total production of coal).

Crist also mentioned that SEGCO's capitalization will consist of $105 millions of bonds and $53 millions of equity by 1962.

Later the group visited Atlanta industries, flew over generating plants in the four-state system, heard a talk in Mobile by the governor of Alabama, and toured Gulf Power Co's new Pensacola, Fla., offices.

A few days after the tour, Southern Co officials summed it up as "very successful." One added, "We'll be having another one in four or five years."

Guidelines Drawn on U.S. Relocation Standards

An outgrowth of liaison efforts, the AASHO's new national standards steer clear of reimbursement issue, but promise to ease some tough stipulations. State approval expected

A new set of national standards on utilities' relocations along the 41,000-mi interstate network is in the process of being adopted by the American Assn of State Highway Officials. This is tantamount to becoming mandatory requirements by the states and the Bureau of Roads.

The new standards reflect a more moderate approach to utility matters than first proposed last summer. Liaison work between AASHO and the American Right of Way Assn's Liaison Committee contributed to recognition for the first time of exceptional relocation problems and hardship cases.

AASHO expects states to act on the measure by Aug. 1, then the standards will be printed and distributed. There is little opposition expected on the changes. The AASHO Planning & Design Policy Committee steered clear of the issue of who pays the cost of relocations. This, the group made clear, is a state and federal matter:

The proposals stipulate that:

- No utilities will be allowed to be installed longitudinally within the control of access lines of interstate highways on new locations. And, any utility located outside of these lines cannot be served by access from the main highway or its

ramps. If the highway has frontage roads, the utilities can be serviced from these as long as the facilities are not within access lines.

If a utility already exists along a proposed right of way for a new highway and cannot be serviced except by using the main road, then the utility facilities will have to be moved. Provision is made for unique and unusual circumstances.

• Where utility facilities are located along a section of highway incorporated in the interstate system, and can be serviced only by using the main highway, then they must be moved. No new or additional utilities can be located along these highways, except along frontage roads.

• Where the interstate highway crosses a major valley or river and utilities are carried by an existing structure, these may continue to be used if relocating them would be unduly expensive. Expansion of these facilities may be permitted if it won't interfere with use of the highway. New utilities will not be allowed to use such structures unless extreme circumstances prevail.

UG Crossings Preferred

• Utilities will be allowed to cross interstate highways, preferably underground. Specific details are provided for overhead and underground crossings, irrigation ditches and water canals, and expansion of utilities at crossings.

• Generally, utilities will not be permitted in tunnels on interstate highways on new locations. Nor will they be allowed in existing tunnels incorporated in the interstate system if they were not there when the roadway became a part of the system. Existing services will be permitted to remain when highway tunnels are incorporated.

• Servicing of facilities normally will be restricted to access via frontage roads, nearly or adjacent roads, or trails along or near the right of way. Where this is impossible, special servicing permits must be obtained from the state highway department.

• Location and design of utility installations, adjustments or relocations must be approved. These will be done in such a manner as to cause the least traffic interference.

'New' TVA Bill Gets Senate Committee Okay

Changes weaken the service area limitations of House-approved version but call for more Treasury controls

An in-again, out-again route of the TVA bond-financing bill last week dimmed the outward accord of the Senate Public Works Committee's unanimous approval of the measure. The printed form of the bill, committee members complained after it reached the floor, failed to jibe with items on which they felt they'd previously agreed. Back it went for a service area revision, then both versions, oddly enough, were approved without dissent.

The delay probably postpones Senate action on it until mid-July.

As approved, it is practically a new bill, even though it still carries the number of the House-passed measure, HR-3460.

The bill apparently is more favorable to private utility desires than the House version, although there are changes both ways.

The bill's supporters have owned up to the fact that a Presidential veto was certain for the TVA bond bills introduced in identical form earlier this year in the House and Senate. And this explains to large degree why they permitted all the changes to be made in the Senate committee.

The bill is tougher than the House-passed version in two respects:

(1) The TVA "service area" restriction has been weakened and three more towns—Fulton and Monticello, Ky., and Oak Ridge, Tenn.—have been exempted from the service area limits. As approved by the Senate committee, TVA can expand into new territory without Congressional approval, if (A) no town over 10,000 population is involved; (B) the area involved is limited to 2,000 sq miles or 2½% of TVA's "primary service" on July 1, 1957, whichever is smaller. Committee staff spokesmen felt that the term "TVA service area," as the House version read, was either unconstitutional or meaningless, and that "the mere connecting of one more house anywhere in TVA's system could have produced a court suit."

Outside States Off Limits

The Senate committee added a clause that TVA could not serve states not being served on July 1, 1957, and limited future expansion to 500 sq mi in any one state at any one time—within the 2,000 sq mi.

(2) TVA is specifically exempted from terms of the Buy American Act.

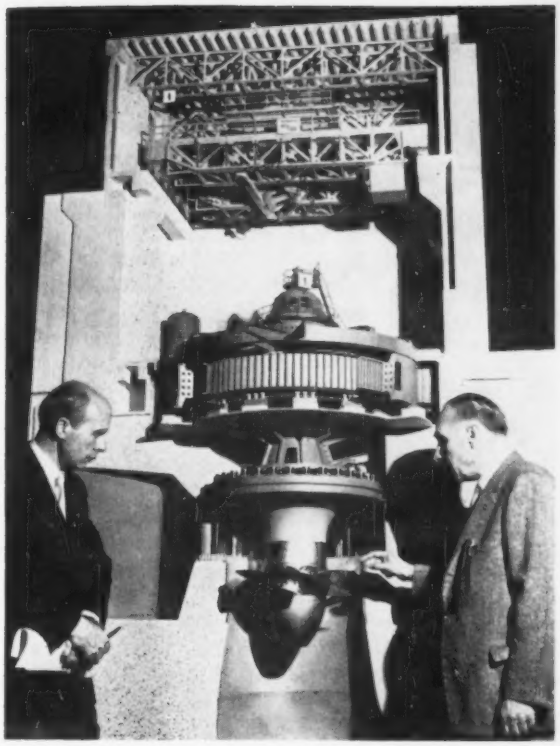
In other major changes, the bill apparently comes closer to private utility desires:

• TVA would not be exempted from the Government Corporation Control Act. This gives the Treasury authority to review its accounts and the investment of funds in government bonds.

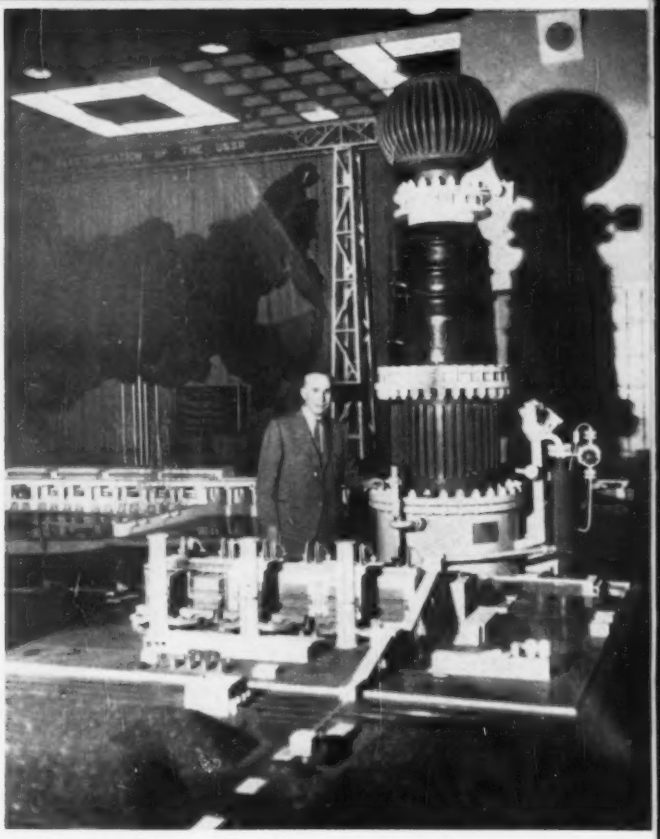
• Also, the Treasury may have its say on the time of issuance and what the maximum interest rate may be for TVA bonds. Treasury may block TVA bond issues up to eight months, but would be required in the meantime to purchase up to $150-million in bonds directly from TVA to replace the blocked issue.

• Proposed TVA expansion or bond-financing plans requiring Congressional approval would have to be before Congress at least 90 days while it is in session before TVA could proceed.

Finally, the repayment provisions for TVA's appropriated debt were amended. Only $1-billion of the present $1.2-billion debt would have to be repaid, but it would be paid off in about 54 years—$10-million annually for the first five years, $15-million a year for the following five years, and $20-million yearly thereafter.

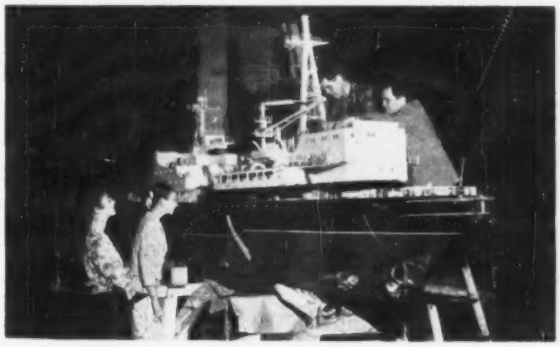


FUTURE HYDRO plants will use bigger Kaplan-type turbines than 110-Mw model viewed by Drs Kalinin, left, Salikov



TRANSMISSION of over 1-million kv dc is feasible now with this 900-amp, 130-kv mercury rectifier, says Dr Salikov

PWR REACTOR model is of one power plant type now under study. In background is model of boiling water type



THREE REACTORS, one of them standby, each can supply 90 tMw for ice breaker. Girls are local press stenos

Soviets Show Off Progress in Power

Visitors to New York City's Coliseum are seeing how the U.S.S.R. compares with the U.S. in fields ranging from fashion to power equipment. The Soviet Exhibition, which runs to Aug. 10, reveals her emphasis on achieving full electrification and power technology.

The power and atoms-for-peace sections take up about 15% of space allocated for a total of 10,000 exhibit items. One highlight is the 900-amp, 130-kv mercury rectifier being used in a 293-mi, 800-kv dc transmission line from Stalingrad to Donbas. The device is going to permit transmission of over 1-million kv "easily," says Dr Alexei Salikov, chief of the exhibit's power section. Meanwhile, the 500-kv Kuibeschev-Urals line has been completed and another 500-kv Stalingrad-Moscow line is nearly finished, Tass reports.

About 1.5-million kw of nuclear capacity is in operation or under construction, Dr Salikov says. Although steam plant construction is receiving priority, important hydro programs still are under way. One of the biggest is in Siberia on the Angara River where 18 turbine sets of 200-Mw capacity each are being installed. Another hydro plant at Krasmsjarskaja will produce 4,200 Mw. Under the latest 7-yr plan, the Soviets are aiming for total production of 500-520-billion kwhr with 110-113-million kw installed capacity by 1965.

Queen Joins in Tribute to Teamwork

Queen Elizabeth II took part in impressive ceremonies at the St. Lawrence Power Project during her visit late last month. Shown above with New York Gov Nelson Rockefeller and the voluble Robert Moses, chairman of the New York State Power Authority, the Queen witnessed unveiling of an "International Friendship Monument" which is in the center of the Moses-Saunders Power Dam. A 60-ft high aluminum arch, the monument symbolizes a handclasp across the U. S.-Canada border.

Truck Maker Bids for Post Office Use

Although the turnout was small, most of those who attended a demonstration of Cleveland Vehicle Co's electric truck prototypes at Canton, Ohio, liked what they saw and heard. Much of the attention was focused on the latest CV model, right, a 1,718-lb (without batteries) "PBX".

The PBX possesses features that are interesting postal officials as well as owners of fleets making comparable multi-stop deliveries. The truck will sell for $3,500, which does not include batteries. CV intends to lease the 600-lb, 250-amp-hr set of batteries for about $20 a month. Range of the PBX is 35 mi per charge, or enough for some 300 to 400 stops. Speed is 30 mph. Load space is 57 x 90 in. Walter Thomas, CV president, said the truck would be tested for three months by the PO. During the one-day demonstration, which Ohio Power Co sponsored, a dairy arranged for trial use of CV's earlier LA model (EW, Feb. 16, p 65).

Rotor Damage . . .

of Memphis turbine caused by shroud band, Westinghouse finds. City meets peak

A thrown shroud band on the No. 3 unit turbine rotor of Memphis Light, Gas & Water Division's plant caused a failure during initial overspeed test. The damage occurred June 4, according to a joint statement by Westinghouse Electric Corp, builders of the 250-Mw turbine-generator unit, and Burns & Roe, consulting engineers on the city's Allen plant.

The difficulty took place a few hours after startup when maximum speed was 11% above rated speed. A shroud band was thrown from the IP-LP element on the 16-in., next-to-last-row of blades. The band went off the row into the following row of stationary blades and also damaged the last row of 25-in. rotating blades. Some condenser tubes were cut as well.

Westinghouse engineers theorized that shroud band rub might have caused enough heat to buckle the shroud band. Another theory, but more unlikely, they said, was that an increase in shroud thickness reduced the length of the rivet extending beyond the shroud and also increased centrifugal force acting on the band.

Ten days after failure the spindle and blade ring had reached the Westinghouse South Philadelphia plant. It took ten days for the company to repair them. The tandem-compound, triple-flow unit is expected to be back on the line about July 9.

During the week of the damage, the city's plant handled requirements for a new 514-Mw peak. On one occasion in May, power from the Tennessee Valley Authority was brought in during a shutdown on the No. 2 unit.

Brazil Gets a Loan

The World Bank has loaned $11.6 million to Brazilian Traction Light & Power Co for projects which will provide 220-Mw capacity in the Rio de Janeiro-Sao Paulo area.

Federal Agency Sought

Sen Stephen Young (D-Ohio) would like to see a Northeastern Power Administration set up. With rates "the highest in the nation . . ." he said on the Senate floor, "it is time that we take steps to develop the electric power resources of this area as has been done in other regions."

Young doesn't plan to introduce laws for such an agency, but he expressed interest in the idea while calling attention to recent American Public Power Assn resolutions. The first defined the area as the only one without a federal agency for overall resource study and called for an NPA. The other said that the 170-Mw allocation of Niagara power to public and co-op systems in Ohio and Pennsylvania requires federal transmission links with the project.

4-to-1 Endorsement

Present service territories of electric utilities in Washington's Puget Sound-Cascade area should remain intact, according to a report on a Puget Sound Power & Light Co survey. "When people in Puget's area were asked if they would like to see Seattle City Light and Tacoma City Light come in and extend their domain where Puget now operates, the idea of such an invasion was rejected by better than a 4-to-1 margin," the report says.

Tacoma City Light, in particular, has been eyeing Puget Power properties in contiguous districts. Tacoma's Public Utility Board recently passed a resolution authorizing a City Light extension in an area Puget Power now serves.

The report, however, says there is a "powerful public aversion to the whole idea of PUD condemnation actions." Three of five people said past condemnations did more harm than good. "By a 2½-to-1 margin, the public feels that the right to condemn another utility's property is not sound or desirable."

One of a series of surveys taken by Louis Harris & Associates of New York, the study found: growing sentiment for public and private power cooperation (a 5-to-1 margin in 1957 vs 7 to 1 this year); approval of Puget Sound Utilities Council (17 to 1 in '57 vs 22 to 1 new); rejection of federal control of electric utilities (5 to 1 vs 6 to 1).

Another survey in the company's area showed electricity has replaced oil as the favored fuel for home heating by 4 to 1.

Jury to Look at Bids

Major U. S. electrical equipment makers have received subpoenas from a Federal Grand Jury that will investigate charges by TVA of identical bids on equipment. About 35 U. S. and foreign manufacturers have been asked for records dealing with recent TVA contracts. Westinghouse and General Electric are among those affected. They said that the products involved are standard items made up of standard components whose book prices appear in catalogs for customers' convenience.

The investigation may provide incentive for hearings on the issue slated by the Senate Anti-Trust & Monopoly Subcommittee for late August. Sen Estes Kefauver, who will handle the proceedings, was described as "very enthusiastic" about going ahead with them.

British Get Turbine Bid

Army Engineers awarded the contract for eight 90,300-hp turbines to English Electric Co, Ltd. The equipment will be manufactured by John Inglis Co, Toronto, which supplied turbines for the Canadian side of the Niagara and St. Lawrence projects.

Low bid was $6,512,313. Other bidders and their amounts: Baldwin-Lima-Hamilton Corp, $9,301,815; Newport News Shipbuilding & Drydock, $9,544,525; Allis-Chalmers Mfg Co, $9,623,060.

Delivery of the first turbine will begin in 1963. English Electric will be required to provide services of an erection engineer while installation will be handled by a general contractor. Units will be covered by a one-year operating guarantee.

This will be the first foreign installation at any of the six Missouri River dams. There are Italian transformers and a West German crane at Gavins Point Dam and English transformers at Garrison. A foreign firm was low on the first go-around to furnish Oahe Dam generators but an American firm won out on the second round.

Pakistan to Power Up

The U. S. three weeks ago approved a $23-million loan to Pakistan to help provide power facilities in the western part of the country.

Reforesting Pays

Starting in 1924 Consumers Power Co began reforesting 20,000 acres of the 125,000 acres around its hydro-electric facilities. The program prevents soil erosion, stabilizes water levels and surface runoff, and provides a potential pole supply to meet 80% of annual pole needs on a sustained yield basis. Russell H. O'Neil, company forester, says that in 1939 they started harvesting this forest crop, and it more than pays the way for reforestation.

On another front, Consumers is exploring ways to attract attention and understanding of homeowners in "the rapidly exploding treeless suburban developments." CP would like to see small trees in them.

Coal Vs. Oil in Britain

British National Union of Mineworkers has accused the government of protecting the oil industry at the expense of coal. Oil imports receive a better deal than coal "because of the political and economic power wielded by oil interests," the union's annual report charges.

DAYLIGHT reveals Agua Fria Steam Station's steel siding, used in lieu of handrails on boiler structure platforms and stairwells and giving effect of a strong architectural bond between boilers and the central elevator tower structure

Steam Plant Combines Low Cost V

Salt River PD builds twin-unit, semi-outdoor Agua Fria for $105 per nameplate kw

T. M. MORONG, Chief Engineer, Salt River Power District, Phoenix, Ariz.
K. H. HAIG, Project Engineer, Bechtel Corp, Los Angeles, Calif.

Appearance can be accorded a high position in the scale of considerations in designing a steam plant, even a low-cost installation. The esthetically pleasing features of Salt River Power District's 200-Mw Agua Fria Steam Plant, near Phoenix, Ariz., are a case in point.

Though the twin-unit plant was completed for only $21 million, the designers expended a maximum of architectural effort to achieve beauty of line and color.

Sharp attention to appearance was dictated by knowledge that continued vigorous growth in the "Valley of the Sun" soon would surround the plant with housing developments, schools, shopping centers, and parks.

The units are 1,800 psig, 1,000F/1,000F, gas or oil-fired. Taking advantage of economies permitted by Arizona climate, Agua Fria is "semi-outdoors," the principal equipment and certain structures being exposed to elements. The cost, corresponding to $105 per nameplate kw or $102 per net maximum design kw, does not include land, switchyard or client charges (interest during construction, liaison, etc.).

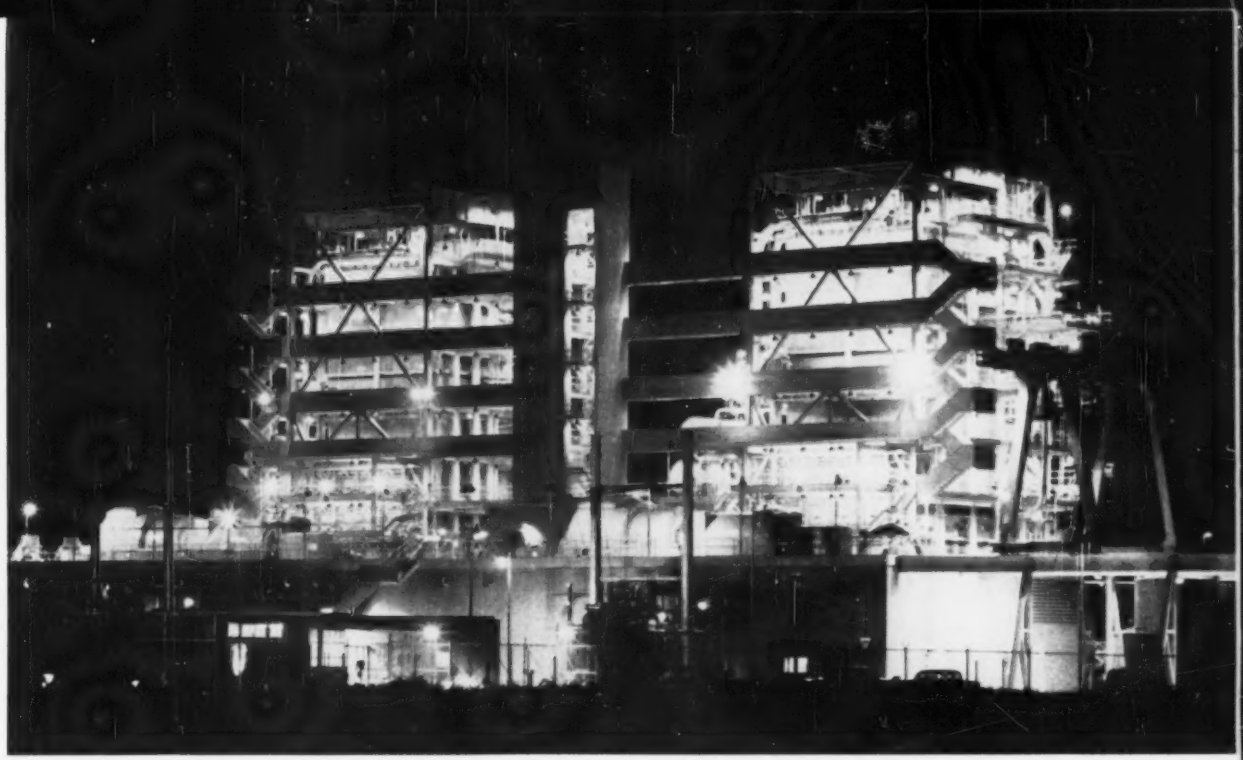
Power District and Bechtel personnel were aware that plants of this type, despite architectural efforts to the contrary, can fall far short of the appearance desired and can resemble process plants. For Agua Fria, therefore, the constructor's engineers and the utility's engineering and operating people held frequent discussions of design and other architectural matters. Evidently, the close attention paid off, as many visitors have complimented the completed plant as a fine example of functional beauty.

The structures were designed for clean simplicity, accented by strong horizontal lines. An emphatic architectural tie between the two tall boiler structures and the elevator tower was achieved by covering the connecting platforms at various levels and the stairwells at the side of each boiler with steel siding. By eliminating the usual exposed pipe hand railings, a definite character was imparted to the predominant structure at minimum expense.

Another contribution to the smooth sweep of the design was use of cantilevered stairs and soot-blower platforms. This sweep permitted elimination of supporting columns, braces, and their accompanying clutter.

Landscape architecture, including planting, ground cover, and night illumination, was planned by leading landscape architects to round out total effect of line, color, pattern, texture, and arrangement.

For simplified design and operation, the two generating units and most of the unit auxiliaries are laid out by "same hand." Thus engineering design for the first unit applied to the second without changing nozzle locations, equipment rotation, etc. With the physical



AT NIGHT, station lighting, besides affording adequate working illumination without glare, also presents a dramatic appearance in the nocturnal Arizona landscape. Elliptical, angle-type reflectors face toward boilers away from viewer

t With Architectural Sightliness

relationship between boiler, turbine, and auxiliaries of Unit 1 preserved for Unit 2's components, piping and wiring repeated itself almost exactly.

Most of the second unit's major equipment was identical to the first's, so that it was unnecessary for vendors to furnish a second set of equipment drawings. This layout method also helps plant operators, as most operating controls are oriented to the major equipment of each unit in the same manner.

The plant is on 40 acres of an 80-acre site. Two similar or larger units can be constructed on the remaining acreage without interrupting or affecting present units. Repair, maintenance, and administration buildings are located and designed to serve future units with minimum alteration.

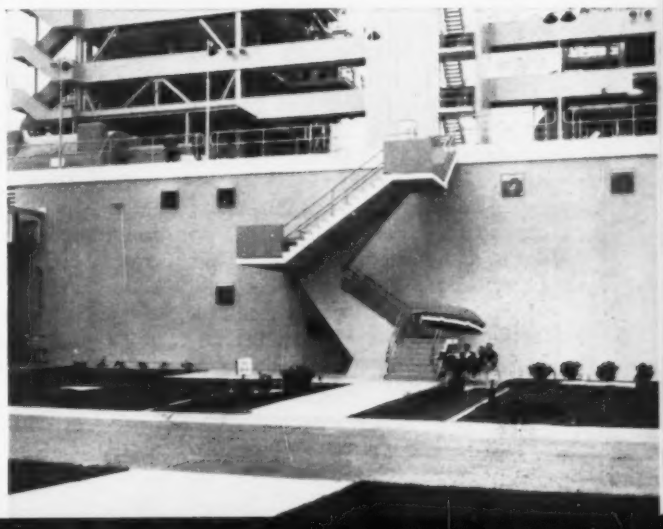
The units burn natural gas or oil and are adaptable for conversion to pulverized coal, space having been provided for coal and fly-ash handling equipment without moving established equipment.

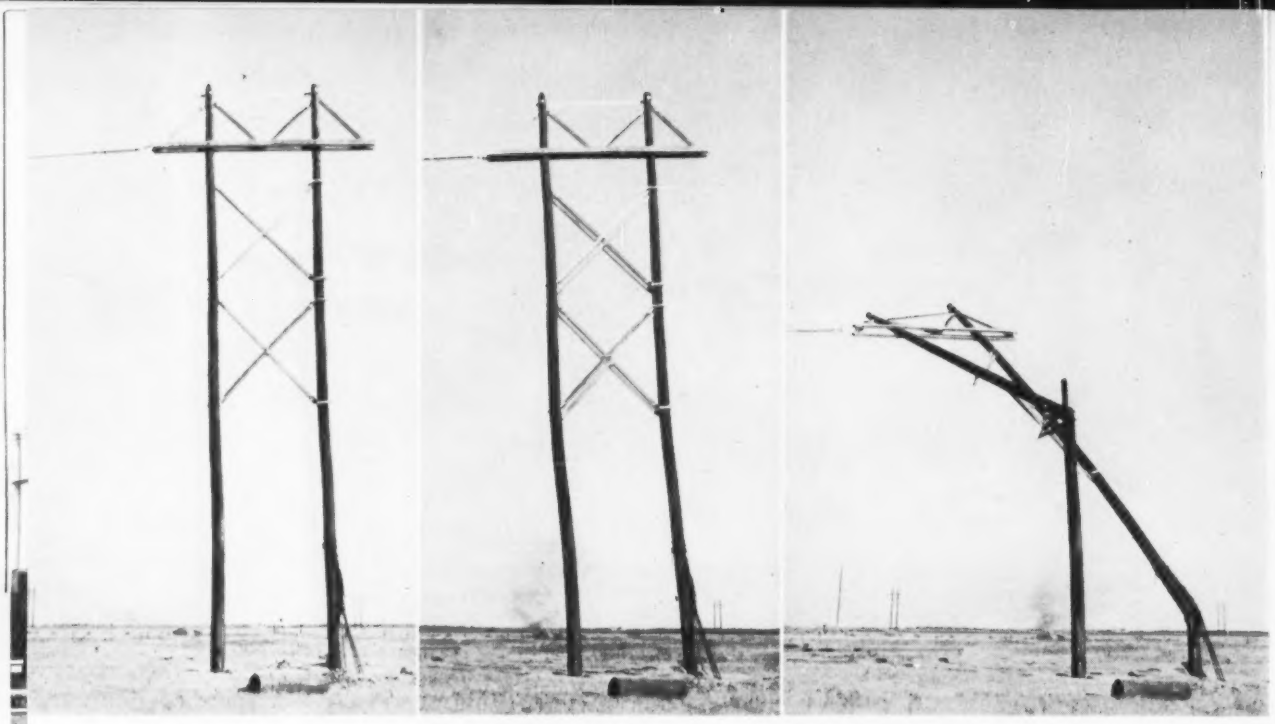
The turbine deck and the entire boiler are exposed, and most plant auxiliaries are housed in the power station building. A three-level control building, centrally situated to serve both units, is built between the boilers, the control room being at turbine-deck level.

The 69-kv switchyard uses suspended-cable bus. Costing less than rigid bus, this design's cable flexibility excels in withstanding earthquake forces. It also enhances switchyard appearance as structural support steel is minimized. Oil circuit breakers, disconnect switches, instrument transformers, etc., are not obscured by complex structural members.

Special care was given to exterior station lighting for adequate working illumination, and glare to persons outside the site has been minimized. More effective lighting was obtained by using elliptical, angle-type reflectors facing toward the boilers. Thus, light sources usually are shielded effectively, the reflectors' elliptical shape greatly reducing the area of bright reflector surface observable from below or at a distance.

STAIRWELLS are cantilevered, as are soot-blower platforms. Elimination of usual support columns and braces gives a clean, uncluttered appearance to overall plant





Test starts . . . **37-in. deflection . . .** **Structure fails**

Structure Tests Set Hurricane R

Simulated loadings carried to pole destruction prompt Central P&L changes in X-brace fittings, bolts and anchoring

W. D. CAMPBELL, Transmission Engineer,
M. U. DOWELL, Engineer, and
F. L. YOUNGS, Engineer, Central Power & Light Co, Corpus Christi, Texas.

Structure tests established the design strength criteria for a H-frame 69-kv transmission line for meeting hurricane conditions in the Corpus Christi area of Texas. The tests showed that Central Power & Light Co's line needed stronger X-brace end fittings and bolts as well as firmer anchoring.

On this Lon Hill-Corpus Christi line, height and transverse strength requirements were greater than on other CP&L 69-kv lines. It was necessary to strike a nice balance among structure strength, pole strength, and resistance to uplift in the preliminary design.

This design called for 995-MCM conductors, a wind load of 25 lb per ft, and a safety factor of 3. This safety factor was a requisite because of the line's importance, congestion in the area traversed, and the unknown fiber strength of the poles. With an average span of 590 ft, the structures had to be set up within an existing right-of-way.

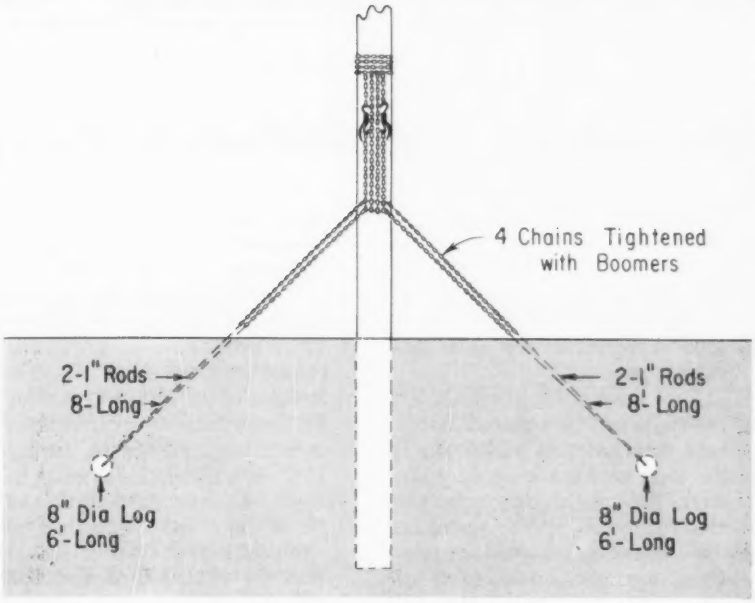
The many 12-kv primary circuits crossing the right-of-way compelled the 65-ft pole height, and strength calculations indicated that Class 2 Southern yellow pine could afford the desired safety factor with two X-braces. Brace and mounting bolts for this pole height and strength had to be stronger than those on other 69-kv structures. The higher poles and two X-braces, calculations showed, increased the uplift strain.

These design problems prompted the full-scale structure tests to determine whether heavier braces were needed and to evaluate the uplift strength of gravel backfill under actual soil conditions.

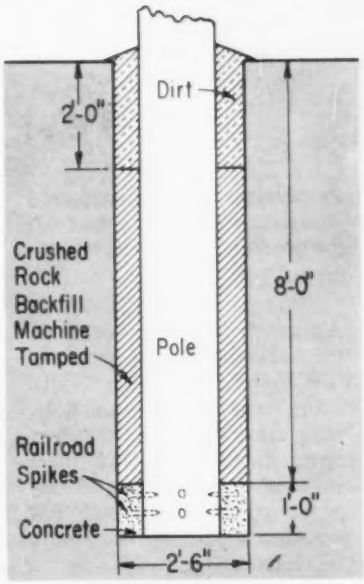
Two 65-ft Class 2 poles were chosen for the tests. These were set and framed, and well tamped coarse gravel was used for backfill. The poles stood for four days before the test began. Then a transverse load of 8,000 lb—equivalent to a 105-mph wind—was applied to the end of the crossarm before uplift movement was appreciable. Once uplift occurred, two 8-in. by 6-ft log anchors were securely fastened to the uplift pole by chains above the ground level. Load was applied again and increased to 12,000 lb, at which end fittings on the X-braces began to show distortion.

Two more X-braces were installed 8 in. below the first ones, making two sets of doubled X-braces. Load was then increased to 21,000 lb, where the compression pole failed. Such a transverse load is not expected. Nor is it expected that the resulting uplift will ever be 70,500 lb. The test load was carried to pole failure simply to check the structure design by utilizing the pole strength fully.

The company's conclusions from the tests were that X-brace end fittings and bolts should be stronger and that anchoring should be substantial enough to prevent uplift. Design accommodations included 1-in. X-brace bolts, and X-brace end fittings of ⅜-in. material attached to the wood member by six bolts. Previous CP&L H-frame construction has had end fittings of ¼-in. material with four bolts and ⅞-in. mounting bolts.



UPLIFT POLE is anchored during structure tests with two 8-in. by 6-ft. log anchors fastened to the pole by chains. Then the line load is increased to 12,000 lb



CONCRETE RING, railroad spikes, and backfill adopted for high-pole line

Requirements for H-Frame Line

On the new construction ⅞ in. through bolts replaced ¾-in. bolts for attaching crossarms to poles. To solve the uplift problem a 30-in. dia concrete ring was poured around poles to a depth of about 18 in. This ring was secured by eight railroad spikes driven into the pole. Above the concrete ring, gravel was machine tamped around the poles to within 2 ft of ground level. The remaining fill was clay and topsoil which would drain moisture away from the pole.

Ralph G. Yerk, chief engineer, Hughes Bros Inc, assisted in the structure design problem and the field test.

Horizontal Deflection—Inches

Load	Cross Arm	Top Upper X-Brace	Bottom Upper X-Brace	Top Lower X-Brace	Bottom Lower X-Brace	Grd Line Thrust Pole	Grd Line Uplift Pole	Uplift In.	Thrust In.	Notes (See below)	Uplift Lb
2,000	4	3	3	3	2	0	0.25	0.1875	0		6,714
5,000	12	11	9	9	7	0.50	0.75	0.50	0		16,786
8,000	22	20	16	16	12	0.75	1.625	0.875	0	1	26,857
8,600										2	28,870
4,000	6	5	5	5	4			0.125	0		13,430
8,000	12	11	10	10	8			0.25	0		26,857
12,000	22	21	18	17	14			0.50	0	3	40,286
8,000	11	10	9	9	7	0.25		0.375	0		26,857
12,000	17	16	14	13	11	0.75		0.625	0.50		40,286
16,000	27	25	21	21	17	0.88		1.3125	0.63	4	53,714
16,000	22	20	18	18	15	0.875		0.875	0	5	53,714
18,000	24	22	20	19	17	1.563		0.875	0.25		60,428
19,000	29							1.25			63,785
19,500	33							1.50	0.50		65,464
20,000	37	35	30	29	24	2.75		1.625	0 50		67,143
21,000	51							1.875	1.06	6	70,500

Above measurements were to nearest ½ in.

NOTES

1. Load released and two patent anchors installed to hold uplift pole.
2. Resultant uplift of 1½ in. Load released, log anchors installed.
3. End fittings began to show distortion—load released. Two sets double X-braces installed, the second set 8 in. below the first.
4. Load released—chain tightened on anchors of uplift pole.
5. Load increased to 18,000 lb, cable clamp slipped, tension released to tighten clamps.
6. Failure at bottom of X-brace on thrust pole.

Test Residential Transformer Demand

C. E. **NELSON**, Supt, Engineering Div, Transmission and Distribution Dept, Philadelphia Electric Co, Philadelphia, Pa.

Effect of the "heat storm" in 1955 indicated a need for a revision in residential transformer loading and testing practices. During that "heat storm" the most heavily overloaded transformers were located mainly by spot testing during the sustained hot spells when temperatures were 90F or more.

Prior to this, all residential transformer testing had been confined to the period of October to April, inclusively. Testing consisted of a ½-hr maximum demand test of the primary current of the transformer, the length of the test period being generally 48 hr. Conversion tables were used to correct for the usual December peaks.

Spot testing for the summer peaks, while satisfactory from load determination viewpoint, if the tests were made on very hot days, did not utilize manpower efficiently. In some summers, these sustained hot spells are relatively few; the limited time for spot testing would not disclose all transformers in need of relief.

The first measure adopted was to reduce maximum winter loading from 160% to 150% of nameplate rating. Thus, during the winter months of 1955-56, relief was provided for a greater number of transformers, most of which would have peaked the following summer. Next, based on analysis of the results of continuing load tests of 34 residential transformers started in January 1955, it was decided to make the ½-hr maximum demand tests between May and September, inclusively, and to tie-in the results with the official maximum temperature recorded in Philadelphia for the day of the test. For example, if (1) the temperature for the test day were over 87F, relief

Oscillograph Helps Boost Reliability

A twelve-element oscillograph helps Indianapolis Power & Light Co improve service reliability on its 13.2-kv distribution system. The Hathaway RS-9 oscillograph pinpoints trouble spots so that corrective measures can be taken.

Oscillographs are calibrated and circuit maps are analyzed. When fault currents are determined from oscillograph records, areas in which faults of that current magnitude would occur are known. By using the records, it is possible to locate the area of the fault more easily.

Because photographic-type oscillographs are used, time is required for developing. Therefore, the main value of the oscillograph is in locating trouble and its cause so that corrective measures can be taken, rather than reducing the time required for restoring service.

The scheme was prompted by changeover of portions of the distribution system from 4 to 13.2 kv. Short circuit currents are much heavier at the higher voltage. Circuits are longer than 4-kv circuits, so more area must be covered when tracing trouble.

The nature of the 13.2-kv protection scheme influenced results. Protection is by instantaneous overcurrent relays and oil circuit reclosers having two delayed operations. From 80 to 90% of all faults are transient. They are hard to locate, even with oscillographic records. However, the records reduced time required and increased the number of faults located.

in Summer Weather

would be provided if the ½-hr demand exceeded 140% of nameplate rating; (2) if maximum temperature were between 80F and 87F inclusively, relief would be provided if tests were over 125% rating; and (3) with temperature less than 80F, relief would be provided if tests were over 115% of rating.

Of the 34 transformers under test, eight were in Philadelphia and the balance in the five suburban divisions. Average transformer loadings expressed in percent (fixed at 100% for the winter peak of 1955) indicate an increase of 3.3% for the 1958 winter peak, while the maximum increase for the suburban transformers indicates a winter increase of 6.8% by 1958, while the summer peak went from 82% in 1955 to 95.3% for 1957. Lower peaks were recorded for the summer of 1958, as the hot weather was not sustained and did not reach the peak temperatures recorded in other years.

Average Transformer Loading Based on 100% Winter Peak 1955

	Phila. Div 8 Transformers		Suburban Div 26 Transformers		System Peak	
Year	Summer	Winter	Summer	Winter	Summer	Winter
1955.....	90 %	100 %	82 %	100 %	86.4%	100 %
1956.....	96.8	100	87.3	102.2	93	98.4
1957.....	110.5	99.5	95.3	104.4	103.9	99
1958.....	102.2	103.3	91.1	106.8	99	103

Preformed Concrete Pad Supports Poles

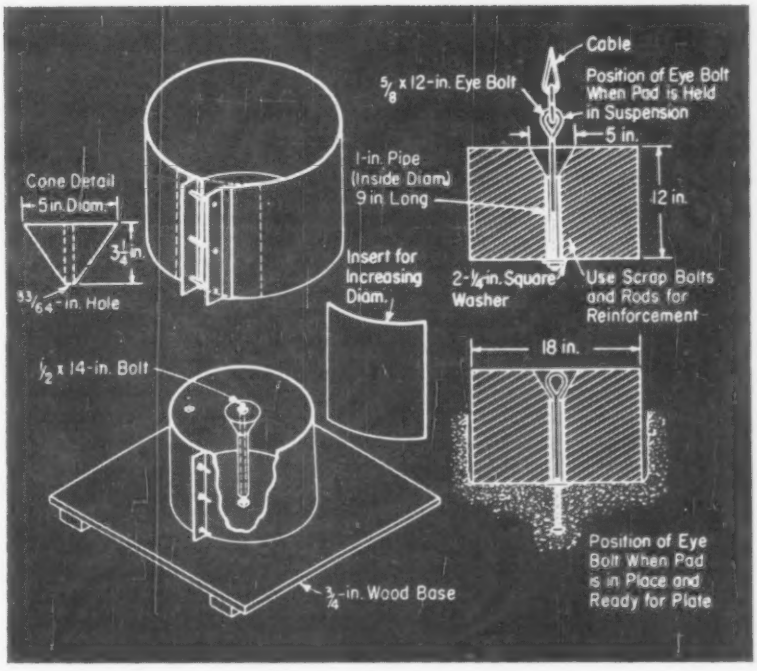
A. R. COWAL, Division Distribution Supt, Ohio Power Co, Canton, Ohio.

A preformed concrete pad can be used where additional bearing surface is needed under a pole. It is particularly suited to transformer and regulator platform settings and poles for cluster mounting of transformers.

The standard pad is 18 in. in diameter and 12 in. thick. It is suitable for the majority of jobs where a pad is needed. A 30-in. diameter pad can be preformed using the same method; however, to facilitate handling, two pads 6 in. thick should be used rather than one 12 in. thick.

Total cost is about $2.75, including $2 for labor and 75¢ for concrete. The metal form and jig assembly for pouring cost $12. Pads can be made indoors during inclement weather.

This technique has eliminated mixing concrete on the job. Estimated savings vary between $20 and $150 per pad.


Cable
5/8 x 12-in. Eye Bolt
Position of Eye Bolt When Pad is Held in Suspension
5 in.
1-in. Pipe (Inside Diam) 9 in. Long
12 in.
Cone Detail
5 in. Diam.
3¼ in.
33/64-in. Hole
Insert for Increasing Diam.
2-¼-in. Square Washer
Use Scrap Bolts and Rods for Reinforcement
½ x 14-in. Bolt
18 in.
¾-in. Wood Base
Position of Eye Bolt When Pad is in Place and Ready for Plate

CASTING FORM for concrete pads is made of 16 gage sheet metal with external flanges for clamping. A sheet metal insert can increase diameter if necessary

Capacitor Ends Flicker from R

H. G. SADDOCK, Rochester Gas & Electric Co, Rochester, N. Y., and
J. A. SAINZ, General Electric Co, Hudson Falls, N. Y.

Installing a series capacitor in the primary circuit of an existing distribution transformer provided an economical and effective solution to a residential welder flicker problem for Rochester Gas & Electric Co. The capacitor equipment includes a new type of inexpensive resealing protective gap, which provides positive protection against excessive overvoltage across the capacitor.

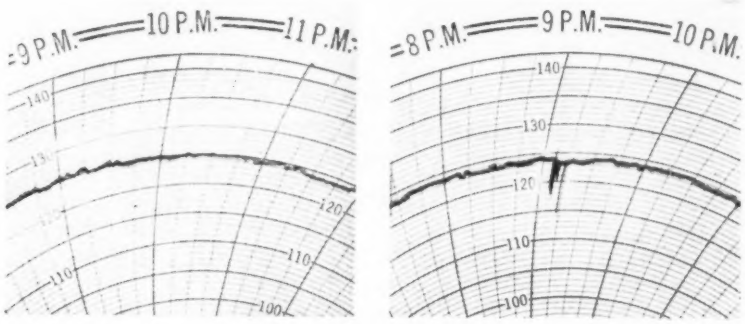
The installation has reduced the maximum voltage dip produced by the 100-amp, 240-v welder from 6% to approximately 1% at the transformer's secondary terminals. Less than one hour was needed to install the unit. The transformer was de-energized only 20 min for final connections. Cost of the unit was $122, compared to $250 and $600 for two other possible solutions.

The customer using the welder was one of eight residential consumers served from a 25-kva distribution transformer. The maximum number of welding cycles was about 25 per hr, each cycle of one-min duration.

Requesting the customer to stop using the welder was quickly ruled out as inconsistent with RG&E's program to promote load growth.

Replacing the existing 25-kva transformer with a 50-kva unit would only reduce flicker to 3%. Since thermal loading was not a problem, change-out to a larger unit would result in a considerable excess of transformer kva. Cost of the change would be $250.

Installing an additional trans-



COMPARISON OF VOLTAGE CHARTS made before (left) and after (right) installation shows effectiveness of sealed gap series capacitor in reducing flicker

Evaluate Distribution Tr

Must consider operating costs, in addition to amortization, for true economic value

A. W. EDWARDS, Engineering Manager, Distribution Transformer Department, Westinghouse Electric Corp, Sharon, Pa.

Typical Performance Values for a 7,200-v Line of Distribution Transformers

(Guaranteed Loss Limits)

Kva	Iron Loss (Watts)	Combined Iron & Copper Loss (Watts)	% Impedance	% Exciting Current
10	67	250	2.0	1.5
15	90	345	1.9	1.5
25	130	505	2.0	1.5
37½	172	690	1.8	1.5
50	215	885	1.8	1.5
75	290	1,225	1.5	1.0
100	365	1,540	1.5	1.0

The amortized cost of a distribution transformer and its installation accounts for only about half of the annual costs of the unit. Additionally, operating costs must be considered to obtain a true evaluation of the transformer.

Operating costs that must be considered include:

1. Cost of iron loss—the no-load loss.

2. Cost of copper loss—the load loss.

3. Cost of regulation or profit loss on lost revenue due to voltage drop.

4. Cost of exciting current.

The iron or no-load loss of a transformer is a constant, independent of load. Table I lists some representative values of iron loss for transformers of recent manufacture.

The cost of supplying this loss can be broken into two components:

1. Energy charge—the actual per-unit cost of producing the power at the generating station.

2. Demand change—the amortized system investment required to transmit and distribute that power to the transformer location.

In a typical system with a 50% load factor, the cost of iron loss would be of the order of 10% of the annual operating cost on a modern transformer.

Residential Welder

former to serve only the customer with the welder would satisfy other consumers. But the welder customer would still experience dips exceeding the desired 1% limit, even with an individual 50-Kv transformer. Installed cost of the additional transformer would be about $600.

The series capacitor responds instantaneously to sudden load changes and generally is the only practical solution to rapidly fluctuating inductive loads. Prior to the presently available sealed gap, RG&E had experimented with an air gap protector, with unsatisfactory results. The gap included on the present installation was designed specifically for distribution transformer series capacitor application. It has thermal capacity to withstand faults on the transformer secondary for durations normally encountered with primary fuse or secondary breaker protection. Under abnormal voltage conditions, the gap breaks down and reseals every half cycle. Peak voltage across the capacitor is held to about 2.5 times its rated peak voltage. When normal voltage returns, the gap automatically re-inserts the capacitor into the circuit.

The recommended 5-kvar, 240-v capacitor unit, with a 240-v gap, was inserted between the neutral terminal of the existing transformer primary and ground. The gap is connected directly across the capacitor. The stainless steel gap body, which is one terminal of the gap, is mounted directly on the ground terminal of the capacitor. Since the continuous current rating of the capacitor is twice the rated current of the transformer primary, the hot terminal of the capacitor does not usually exceed 120 v to ground under normal conditions. Total cost of the capacitor and gap installation was $122.

Voltage charts taken after the installation showed that voltage fluctuations during welding were minimized. A further check was made by watching the customer's television while he was welding. No flicker was visible on the screen. In addition to eliminating the customer complaints, the average secondary voltage level has been improved about 1% under normal loading conditions.

Based on the results obtained with this installation, RG&E plans to make further use of the series capacitor distribution transformer application as an economical means of coping with voltage flicker.

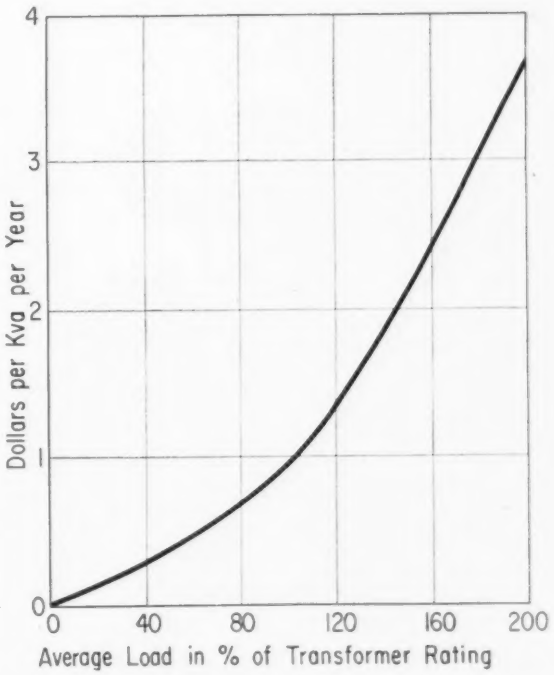
Transformer Costs

Copper loss varies with the square of the load. For a typical transformer, copper loss at rated load is about 2½ times iron loss. Overloading results in a greatly increased copper loss. For example, at 200% load on a typical unit, copper loss is ten times iron loss.

Because copper loss varies with the square of the load, average copper loss must be evaluated in terms of RMS transformer load. As in the case of iron loss, copper loss should be evaluated in terms of a "demand" and an "energy" charge. Copper loss varies widely as a function of load but for typical cases is about 35% of operating cost.

Cost of regulation is the cost of the loss of profit due to lost revenue because of low voltage at the customer's meter. A portion of the load on a transformer may be considered voltage-sensitive. That is, the energy consumed by part of the load is dependent on the voltage supplied to it. Incandescent lights and certain motors, such as those for fans, are examples.

Thermostatically-controlled devices are typical non-sensitive loads. Low voltage on an oven will reduce kw demand but not kwhr consumed, because the oven will operate longer to maintain the same temperature. Studies indicate that about one-third of distribution



COST OF REGULATION in terms of per cent load must be evaluated in terms of the RMS load, as for copper loss

transformer load is voltage-sensitive.

The relationship between energy consumption and voltage for voltage-sensitive loads is not constant. For some lighting loads, power consumed varies with the square of the voltage. For motor loads, a more linear relationship generally exists. An average figure is that energy consumed varies with the 1.6 power of voltage supplied to the load for voltage-sensitive loads.

Because of these factors, one can assume that for every 1% drop in voltage, there would be a ½% drop in energy delivered to the load. Because load is variable during the year, the net cost of regulation must be evaluated in terms of RMS load, as for copper loss.

Transformer exciting current, like iron loss, is a constant value independent of load. It is generally a minor problem, representing less than 1% of total operating cost.

Sample calculations have been made for annual costs of a 15-kva transformer, with an average load of 75% and a load factor of 50%. These are as follows:

Transformer	$48.99
Copper Loss	33.29
Iron Loss	9.23
Regulation	7.50
Exciting Current	.52
	$99.53

This indicates that operating costs are just as important in evaluating distribution transformer performance as the first cost of the transformer.

It is important, therefore, to provide means for determining load conditions on a transformer. Signal lights on CSP-type transformers or overload indicators on conventional units give an economical indication of changeout time. Once the annual peak has reached a load sufficient to operate the signal device, the annual average load is near the economic loading limit for that unit. This is true for a wide range of annual load factors.

Capacitors Installed for $7 per Kvar

CLIFF MAULSBY, Senior Designer, Idaho Power Co, Boise, Ida.

Large blocks of reactive kva can be provided at minimum cost on 20/34.5-kv distribution lines by utilizing a two-pole structure and wood rack. Idaho Power Co has installed 15,300 effective kvar by this method on 250 miles of distribution at an installed cost of $7.02 per kvar.

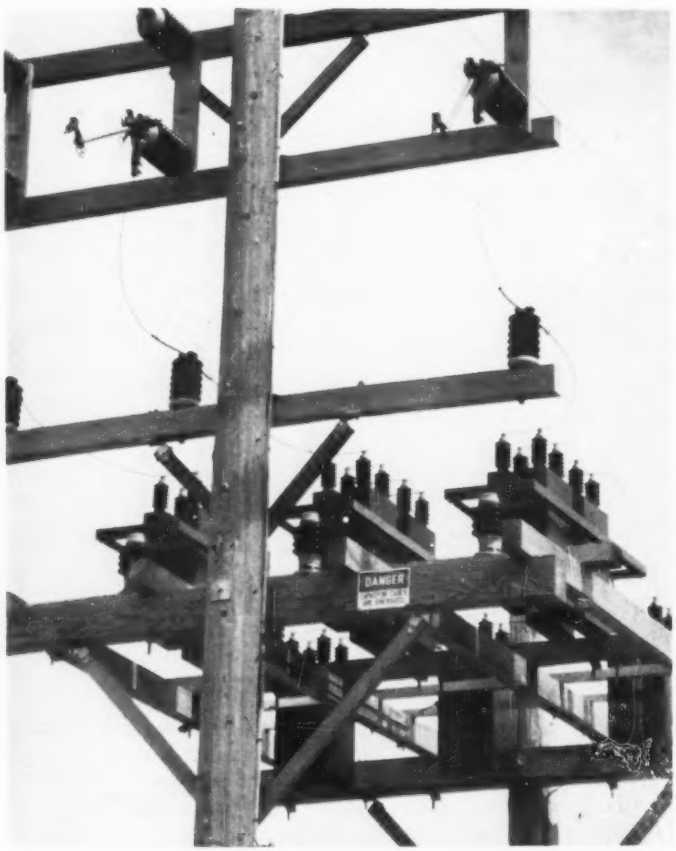
The installation uses 7.2-kv, 50 kva capacitor units arranged six per phase in a series-parallel arrangement providing 900 nominal kvar per bank. The first and second series steps (the first four units) per phase are isolated from ground in one common frame mounted on station post insulators. The midpoint between the two steps is connected to the frame, thus maintaining voltage limits on the capacitors.

The third series step, or last two units, per phase is solidly grounded, tying the bank neutral to ground.

As with previous Idaho Power capacitor installations on 20/34.5-kv feeders, 7.2-kv units were used because they are interchangeable with the balance of the system capacitors and also provide a safety margin in voltage.

Twenty structures of this 900-nominal (765-effective) kvar design were installed in 1957 on 250 miles of 20/34.5-kv distribution serving about 40 Mw of predominantly irrigation pumping in an area of above-normal wind velocities. Timbers and metal rack components were precut and bored in the shop before being distributed by flatbed trucks, thus using all power equipment and eliminating excess travel and up-the-pole construction.

Since irrigation load is continuous over the season, the capacitors are unswitched and left on during the summer pumping season. Each phase is fused and switched with a 200-amp 34.5-kv load break switch.



FOREGROUND units are mounted in frame isolated from ground on 15-kv insulators. Rear units are grounded

Compliant Elements Reduce Noise Levels

C. C. **HONEY**, Research Engineer,
L. R. **TOOTHMAN**, Research Engineer, Pennsylvania Transformer Div, McGraw-Edison Co, Canonsburg, Pa.
K. C. **STEWART**, Associate Professor, University of Pittsburgh, Pittsburgh, Pa.

Considerable reductions in oil filled transformer noise levels may be possible through the use of compliant elements. Compliant elements are devices which have characteristics of springs, and shunt the velocity of vibratory forces before the forces reach the tank walls.

The possibility of reducing noise with compliant elements was revealed through a study of transformer noise using dynamic analogies, whereby a vibrating mechanical system of mechanical resistance, mass and springs is transformed into an equivalent electrical network of resistances, inductances and capacitances. The above system may be considered a system of lumped constants, if transformer size is visualized as being very small in relation to wave lengths of sound.

Energy density inside a transformer may vary markedly, because vibratory force vectors at some points may be additive and at others subtractive. High concentrations of vibratory forces may be represented analytically as force generators. It is convenient to represent force generators as constant-current generators for dynamic analogies.

Fig. 1 shows a mechanical diagram of forces in an untreated transformer, and Fig. 2 depicts the equivalent electrical circuit. M_o represents the mass of oil associated with the movement of the tank wall mass M_t. S_t represents stiffness of the tank wall and R_a is the air load resistance on the tank wall through which sound is radiated. F_r is the acting force generator, while F^1_r is the associated reacting force through which F_r exerts vibratory forces on the tank wall. In Fig. 2, $\dot{x}$ is the velocity of the vibrator forces driving the tank wall and is defined as current in the equivalent electrical circuit. As R_a is small, the current of mesh 2 of Fig. 2 will primarily depend on the relationship between equivalent inductive and capacitive reactance.

Where tank walls have sections of local resonance, the currents within these sections are much higher than under non-resonant conditions. Resonance results in large radiated sound levels due to the greater power dissipated by the

(*Continued on page 96*)

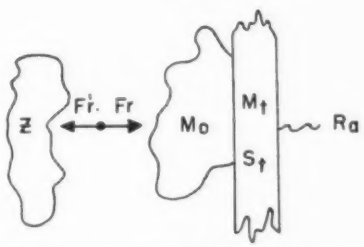


FIG. 1. Mechanical diagram of forces in untreated transformer provide start

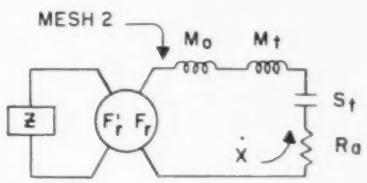
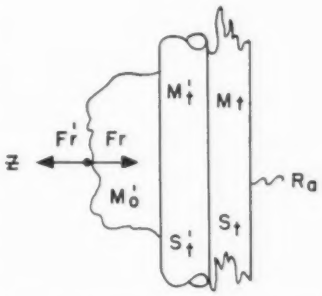


FIG. 2. Mechanical diagram can be converted to electrical circuit diagram



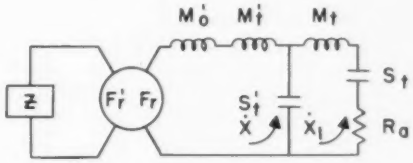


FIG 3. Compliant element placed on inside transformer wall shunts sound radiation mesh. An element containing as little stiffness as possible is best

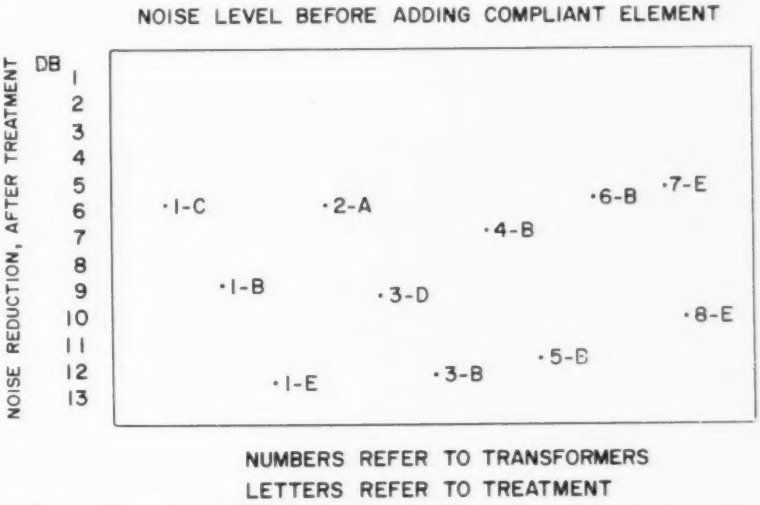


FIG 4. Experimental data obtained by use of different compliant elements indicate that more experiments will be necessary to obtain sizeable noise reductions

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FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

Procurement & Products

COAL ▶ **Montana Power acquires lease on 3,300 acres of coal lands,** with deposits of some 50 million tons of sub-bituminous coal, to assure a future source of low-cost fuel. Utility will pay mining royalties to Northern Pacific Railway, which holds the lease.

OIL ▶ **Further shakedown on crude oil prices?** Industry sources say there will certainly be price drops unless refinery runs are "cut drastically and cut quick" to reduce a rising surplus. Reductions in crude prices would be followed by drops in residual fuel oil prices.

METALS ▶ **Copper** fabricators would be able to weather a month-long producer strike without closing operations. That's gist of study made by Engineering and Mining Journal Markets newsletter. This would mean that brass mills and wire mills have enough copper on hand to continue normal operations.

Aluminum prices could recover most of the 1.3¢ drop now that output is getting within 15% or more of capacity and prospects are for further improvements in general business conditions and in use of aluminum.

Steel inventory of two largest electrical manufacturers firms were built to hedge a strike of a month or two in the steel industry. GE reported a reserve to carry most divisions from nine to 18 weeks compared with normal reserve of three to eight weeks. Westinghouse reported its supply would last 60 to 90 days.

OUTLOOK ▶ **A $700-billion economy by 1969 is predicted** by McGraw-Hill's Dept of Economics. To reach this figure, U. S. gross national product will have to grow at 4% a year—vs 3.4% a year since World War II. Business investment will reach $80 billion, and consumers will spend $490 billion in 1969, the economists say, compared with the $48 billion and $328 billion expected for this year. Stimulating this vigorous growth will be much higher research and development expenditures, and a big push for modernization of plant and equipment.

PRODUCTS ▶ **New transistorized mobile radio receiver has only 0.04 amp drain** on battery **(see page 84)** . . . Space-saving high-voltage switch that is completely enclosed in a section of 138-kv isolated phase bus has been developed **(see page 68)** . . . Electronically-controlled, self-regulating distribution transformer is being field tested **(see page 68).**

INVENTORIES ▶ **Are utility inventories adequate?** It may be time to study levels against background of rising business indices **(p 47).**

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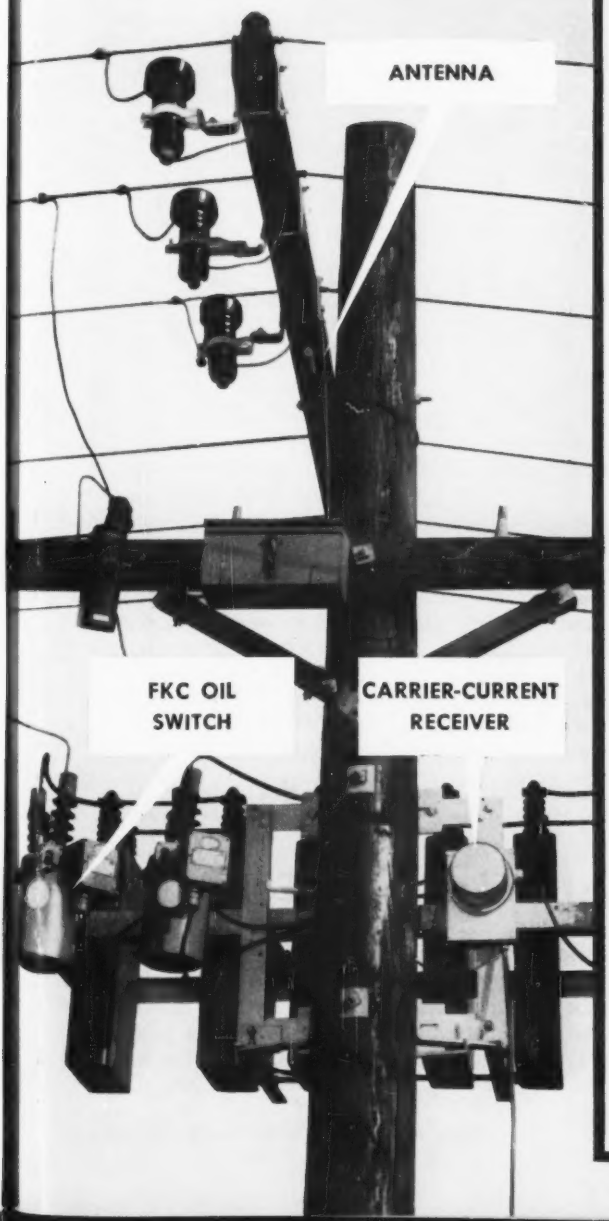
New Equipment . . . . . page 84
Readers Service . . . . . page 86

ANOTHER GENERAL ELECTRIC ***Kilovar Plus . . .***

More Economical System Operation Achieved with Remotely Controlled Capacitors

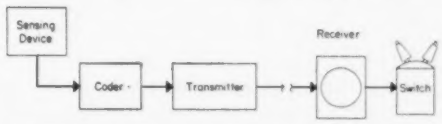
General Electric Switched Pole-top Capacitors with Carrier-current Control Help Baltimore Gas and Electric Reduce the Cost of System Voltage Regulation.



Carrier-current control of General Electric switched pole-top capacitors enables Baltimore Gas and Electric Company to hold most economically good voltage levels over the entire system. Remotely controlled capacitor banks installed on feeders also contribute to more economical operation by reducing power losses and releasing system capacity. The system no longer has to transport vars from the generator to the load area.

CONVENTIONAL CONTROLS respond only to time or conditions at the capacitor site. BG & E found they did not permit maximum use of capacitors on its feeders.

CARRIER-CURRENT CONTROL responds to system reactive requirements measured at the substation. Then this control remotely switches the capacitors on the feeders so that vars are supplied to the load where and when they are needed, and in quantities required for most efficient system operation.



CARRIER-CURRENT CONTROL of G-E switched pole-top capacitors uses a sensing device at the substation bus to detect conditions that exceed preselected limits. A coder initiates action. Tone signals are transmitted by carrier over distribution lines to receivers on capacitor racks, and banks are switched on or off in a predetermined sequence.

BALTIMORE GAS AND ELECTRIC has found that the slightly higher cost of the carrier-current control is more than offset by the benefit of improved system regulation utilizing high distribution power factors. **DISCOVER HOW** G-E switched pole-top capacitors with carrier-current control can help your system. Contact your nearest General Electric Apparatus Sales representative, or write to Section 445-24, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

L-M Develops Electronically Controlled SRT

An electronically-controlled self-regulating distribution transformer has been developed by Line Material Industries. The new SRT supplements the hydraulically-controlled unit announced by L-M last year (see EW, June 23, 1958) and currently undergoing field testing by utilities across the nation.

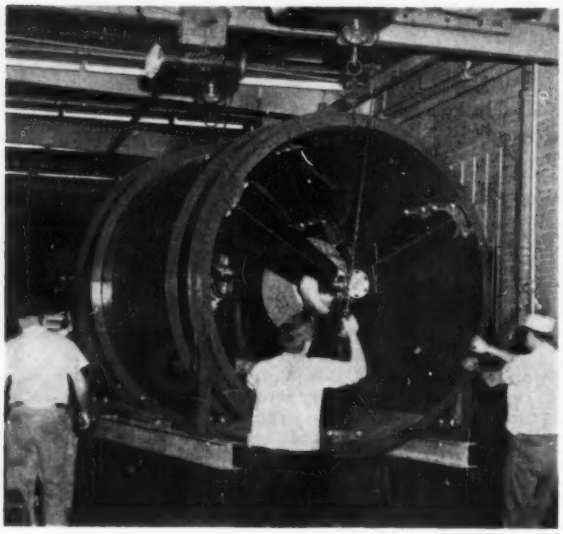
L-M will produce both the electronic and hydraulic SRT's until field test programs on both have been completed. At that time, full-scale production of the more acceptable SRT will be undertaken. The company says utility reports to date have indicated excellent performance of the hydraulic SRT's in service under all kinds of climatic and application conditions.

Operating characteristics of the two types of self-regulating transformers are identical. They sense voltage at the utilization level and maintain secondary voltage in a 3½-v bandwidth about a preset value between 120 and 126 v. Regulation in four 2½% steps can be set for one of three primary voltage ranges—from 90% to 100%, from 95% to 105%, and from 100% to 110%. SRT ratings range from 2.4 through 14.4 kv and from 10 through 100 kva.

Principal difference in the two SRT's is the type of control and its mounting. The new SRT has a sensing unit consisting of encapsulated, miniaturized, solid-state electronic components housed in a metal container. A convenient plug and receptacle permits external mounting of the control on the transformer and facilitates exchange of controls. Each sensing unit is factory calibrated for a specific midpoint setting in the range from 120 through 126 v. Power consumption of the sensing unit and tap changer is 12 w.

Utilizing a standard Round-Wound transformer, the SRT's are applicable: (1) at the end of long lines, (2) where load variations cause erratic voltage, (3) in lieu of a regulator on a long line with few consumers, and (4) to maintain voltage levels in rapid growth areas.

Electronic SRT's are now available on an allocation basis with delivery scheduled for November. Price of these new units will be the same as the hydraulically controlled SRT's of identical rating, says L-M. This can be approximated by increasing the net price of a standard conventional transformer with taps by about 6%, then adding $50.



I-T-E HV Switch Saves Space

A space-saving high-voltage switch that is completely enclosed in a section of 138-kv isolated phase bus has been developed by I-T-E Circuit Breaker. Shown at left, the switch has three insulators Y-mounted under compression for strength and uniform electrostatic field. With the new switches, which can be built either vertically or horizontally, metal-enclosed switching stations can be built on one-half the space required for open switchyards, says I-T-E.

Switch is operated by rotating one of supporting insulators, turning pinion which moves rack mounted within switch blade. This telescopes blade into hollow conductor and eliminates need for extra blade storage space. Switch can be built in range of 69 through 230 kv and current up to 2000 amp, matching in diameter appropriate isolated phase bus size for that voltage.

GE to Build Automated Control System for So Cal Edison

General Electric will build a computer-directed control system for Southern California Edison's Huntington Beach generating station. The completely automated units will supplement the existing 400,000-kw facility there and will contain two new 210,000-kw cross-compound steam turbine-generator units to be supplied by General Electric and Westinghouse.

Completely automatic hot and cold starting will be provided by the electronic control system, as well as normal and emergency shutdown, continuous performance calculations, and constant control of the boiler-

(*More News of Manufacturers, p* 70)

STILL GOOD AS NEW
These performance-proved Kerite Cables and terminals are still giving trouble-free, dependable service.

AND INSTALLED AGAIN
When planning future power needs, long cable life is a must. There's never a doubt when the installation is Kerite.

Basis for purchase: **PAST PERFORMANCE**

LARGE UTILITY INSTALLS KERITE CABLE AGAIN

Past performance of Kerite Cable and Kerite terminal methods led a major electric utility to install 1250 MCM 15 KV Kerite Cable generator leads at one of its newer stations. Kerite Cable has been giving like-new service at an older station since installation. It *still* is today.

Exceptional long life, rugged dependability, and resistance to the worst that the elements can inflict are the qualities that make Kerite the cable that is ***reordered*** by users—time after time.

KERITE CABLE

It's KERITE *that makes the difference*

Our headquarters is at 30 Church St., New York 7.

BRANCHES IN
Ardmore, Pa., Boston, Cleveland, Chicago, Houston, San Francisco, Glendale, Cal.

GE Builds Automated Control System

(*Continued from p 68*)

turbine-generator system.

The computer system will continuously scan 900 points, log 50 critical quantities each hour, and identify and print out information from more than 300 alarm points. Maximum scanning rate will be 300 points per second. Information will be stored in a 16,000-word magnetic drum memory.

Corrective action for abnormal conditions detected during on-line operation of the system will be initiated automatically by the computer, says GE. In the event that the control is unable to make a permanent correction of an abnormal operating condition, it will make a stopgap correction and sound an audible alarm that alerts operators and directs them to the problem area.

The utility expects the automatic control system will provide increased operating safety and reliability, improved continuity of service, and reductions in fuel, operating and maintenance costs.

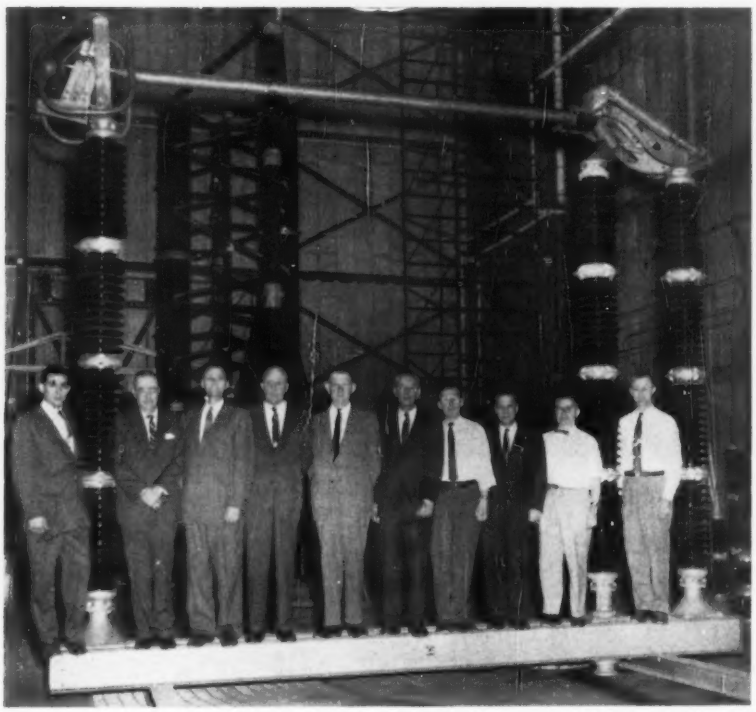
Bechtel Corporation is the consulting engineer for the power company's expansion project, which is expected to be completed late in 1960.

MANUFACTURERS BRIEFS

Allis-Chalmers is supplying two 47,368-kva generators to the U. S. Army Corps of Engineers' Bull Shoals Dam under a $1,796,432 contract . . . **Hevi-Duty Electric** merged into **Basic Products Corp** June 15 and will operate as a division headed by Harold E. Koch, former Hevi-Duty president, newly elected BP board member. Anchor Mfg. Hevi-Duty subsidiary, becomes a BP Corp subsidiary through the move . . . Florida Power Corp has ordered for its expansion of the Paul B. Bartow power plant a total of 8,000 hp in auxiliary motors from Electric Machinery Mfg to drive forced draft, induced draft, and recirculating fans. Boiler feed pump and condensate pump drives are included . . . **Delta-Star Electric Div,** H. K. Porter Co, introduces a new line of corona-free connectors for voltages above 161 kv. The division also lists a 400-kv vertical-break air switch, Type MD-40, as a standard product in the outdoor switch section of its new catalog.

. . . **Westinghouse** announces price reductions of from 5 to 15% on a number of incandescent and small mercury lamp luminaires for residential use, higher intensity mercury units for thoroughfares, expressways and turnpikes, also on the newest mercury lamp luminaire, the OV-25 "Silverliner," 400-watt. Price reductions for mercury ballast for nearly all models are included . . . Endowment of $250,000 from the Westinghouse Educational Foundation has established the A. W. Robertson chair in economics at Allegheny College, in honor of the former Westinghouse chief executive, an alumnus . . . **Subox, Inc,** discloses that recent inspections of metal protective paint jobs using Subox, Subalox and Capox paints indicate that the average life per single coat can be extended from 5-8 years to 8-10 years. Several electric utilities have changed their repaint cycles, says Subox.

(*More Products & Procurement p 84*)



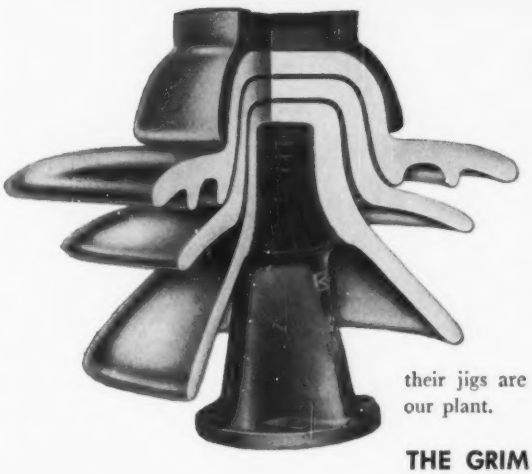
345-Kv Delta-Star Switch Passes Test

Tests on a 345-kv, 1470-BIL switch have been completed at the new John Lapp Laboratory of the Lapp Insulator Co, Inc. The switch was by Delta-Star division of H. K. Porter Co, Station posts by Lapp.

Engineers from American Electric Power as well as Delta Star and Lapp (shown above) were present at the tests.

TAKE A LOOK AT QUALITY...

VICTOR QUALITY!



No. 729 (EEI-NEMA 58-7)
Switch and Bus Insulator

PROOF OF THE PUDDING

Design that has been proven in thousands of installations, quality control manufacturing that maintains complete uniformity, conscientious testing procedures that insure conformance to VICTOR's high standards – these have given VICTOR Switch and Bus Insulators an enviable reputation for reliability under extreme conditions of service. The three shells, cap and pin are precision assembled with premium grade insulator cement. They're put together to stay! Sub-station service by some of the country's foremost utilities prove that VICTOR stacking units are made better, assembled more accurately, are more thoroughly tested, and last longer than any other switch insulators on the market.

JIG ASSEMBLED, BUT NOT IN JIG TIME

VICTOR Switch and Bus Insulators are assembled in tempered, cast iron jigs to assure accurate alignment and easy stacking. This is a long, time and money consuming job. Each insulator is separately assembled in its individual jig and the jig clamped shut. All shells, cap, pin and bolt holes seat perfectly and are in perfect alignment. Rows and rows of these insulators in their jigs are continually in process at our plant.

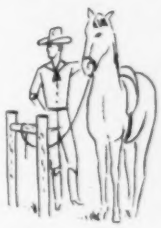
THE GRIM DESTROYER

That's what we call each of our mechanical and electrical lab engineers. It's tough to see one of these men take perfectly good switch and bus insulators, put them on testing machines and watch him run them to destruction. In fact, we have a pile of broken insulators to add to our dump heap every day. Only satisfying thing about the awful mess is that these insulators proof-test at values up to double their EEI-NEMA ratings before failure occurs. This assures maximum tensile, torsion and cantilever strength . . . gives a comforting margin of safety to your installation.

A REAL BEAUTY

As insulators go, the No. 729 is a real beauty! Its smooth, rich, mahogany glaze gives that distinctive VICTOR look of quality. Its heavy, galvanized cap and pin add handsome color contrast. Its cemented surfaces are smooth and white. A real beauty in appearance – and performance.

PORCELAIN HITCHING POSTS



Special processes have to be employed if three shells, a cap and a pin are to hold together under the terrific strains and stresses Switch and Bus insulators must undergo. Cementing them with premium grade insulator cement is not enough. This cement has to have something more than smooth porcelain to hang on to. That's why VICTOR coats the bonding surface of each shell with a layer of slow drying glaze and, while wet, impregnates these coatings with porcelain "sand" or grit. Result: thousands of "hitching posts" to which the bonding cement can adhere.

BUILT-IN CUSHION

You can't just cement cap, pin and shells of a switch and bus insulator together without certain precautions. For example, take the matter of expansion. The coefficient of expansion of metal is different from that of porcelain. Therefore, in extremely hot or cold weather, the metal parts and the porcelain parts of an insulator expand and contract at different rates. That's why VICTOR coats the bonding area of every cap and pin with a viscous, water-proof, resilient compound. This compound forms a cushion that safeguards against injurious expansion and contraction at extremes of temperature. For full specifications and details on VICTOR Switch and Bus Insulators, write I-T-E Circuit Breaker Company, Victor Insulators Division, Victor, N. Y.

I-T-E

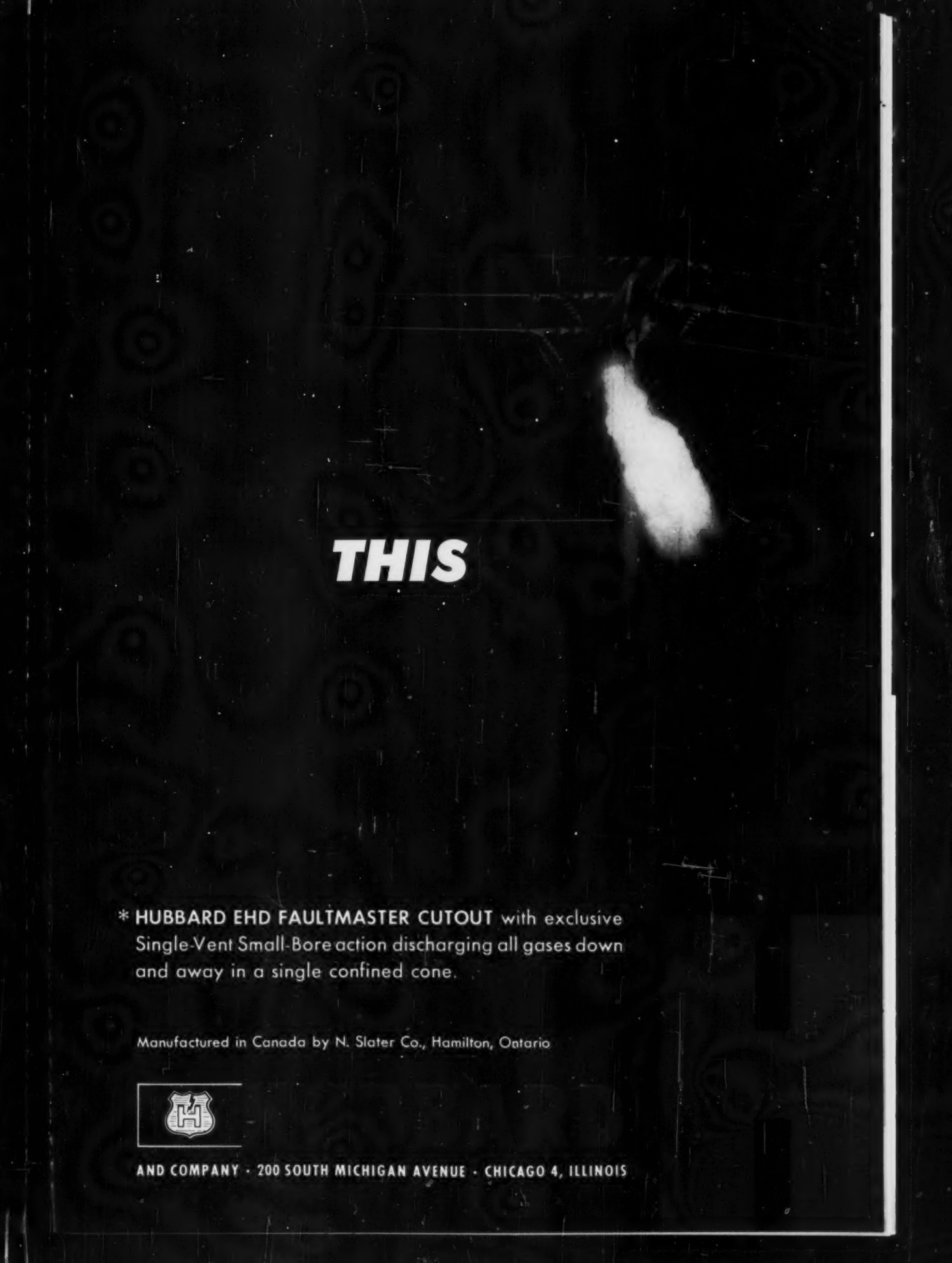
I-T-E CIRCUIT BREAKER COMPANY

VICTOR INSULATORS DIVISION

when it comes to CUTOUTS

* **PRESSURE-RELIEF CAP CUTOUT** photographed in action discharging the cap, fuse link button head, and ionized gases upward into the primary.

* *Both photographs are open shutter exposures, taken of cutouts tested on a 15 kv circuit with 8000 amperes available.*



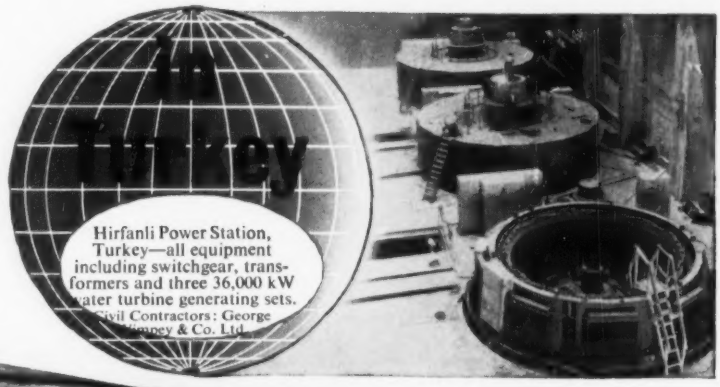
* **HUBBARD EHD FAULTMASTER CUTOUT** with exclusive Single-Vent Small-Bore action discharging all gases down and away in a single confined cone.

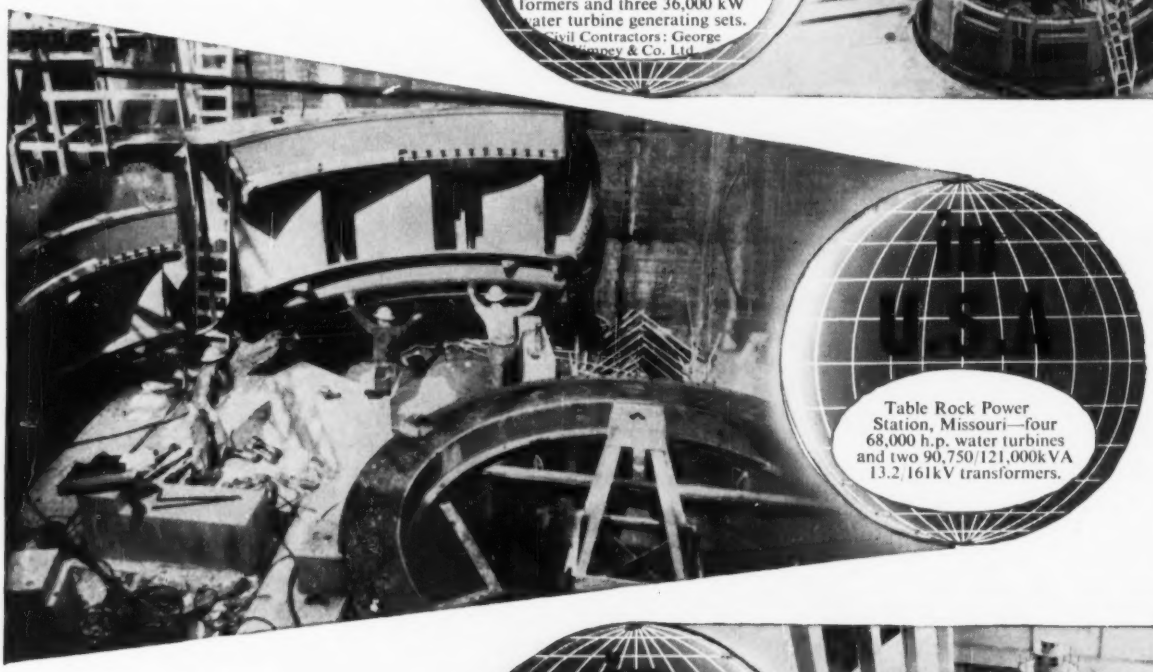
Manufactured in Canada by N. Slater Co., Hamilton, Ontario

AND COMPANY · 200 SOUTH MICHIGAN AVENUE · CHICAGO 4, ILLINOIS

Helping to generate the world's power

'ENGLISH ELECTRIC' water turbines and generators are meeting the power requirements of many countries throughout the world. At three major schemes in the United States, 'ENGLISH ELECTRIC' hydro-electric equipment will be adding some 1,630,000 h.p. to America's power potential.


In Turkey
Hirfanli Power Station, Turkey—all equipment including switchgear, transformers and three 36,000 kW water turbine generating sets.
Civil Contractors: George Kinney & Co. Ltd.



'ENGLISH ELECTRIC' products cover all aspects of the generation, transmission and utilization of electric power. Service facilities are available through three large Canadian plants. Contracts have been completed and are in hand for many other major American power projects.

In Australia
Munyang Power Station, Snowy Mountains Hydro-Electric Authority, Australia —two 30,000kW water turbines and alternators.

'ENGLISH ELECTRIC'

Agents for Washington, Oregon, Montana, Idaho, Wyoming, Nebraska, California, Arizona, Utah, Nevada and Alaska: **James I. Metcalf & Co. Inc.**, 701 United Pacific Building, Seattle 4, Washington. Branch offices in San Francisco, Los Angeles, Portland, Phoenix. Agents for Georgia, Alabama, Tennessee, South Carolina, Florida and Kentucky: **Osgood & Associates, Inc.**, 988 Spring St., N.W., P.O. Box 7383, Station C, Atlanta 9, Ga. Agents for Louisiana and Mississippi: **Electron Equipment Co. Inc.**, 1050 Constance St., New Orleans, 13, La. Agents for Texas, Oklahoma, Arkansas and New Mexico: **Peabody Bros.**, 2903 St. Louis St. at Oakland, Dallas 26, Texas. Branch offices in Houston and Tulsa.

Enquiries for territories not covered by Agents should be directed to:

ENGLISH ELECTRIC EXPORT & TRADING CO. LTD., 750 THIRD AVENUE, NEW YORK 17, N.Y. Telephone: MURRAY HILL 7-0303

OC/US/3

Target Program Builds Balanced Load

Through an aggressive and well-directed load building program Central Power & Light Co has increased the kwhr sold per customer per year and has improved its relative position on this score nationally and with relation to other companies in the Southwest (see chart below).

The entire activity is aimed at offsetting the peaking effect of air conditioning loads. There was no effort at reducing the growth in air conditioning since this is considered a profitable load in South Texas where comfort cooling devices are used every month of the year and extensively for about nine months. However, the promotional efforts were directed at increasing sales of equipment that would operate on more of a year-round basis, or, where possible, in the winter when air conditioning would not be operating.

Before launching the program, a thorough study was made of loads in all categories, residential, commercial and industrial. A five-year "Target Program" was then worked out. Objective: To increase kwhr sales and improve load factor, or at least reduce, and if possible stop, the downward trend in the load factor curve.

Promotes Certain Appliances

The studies showed that in the residential field the promotional activities should push ranges, water heaters, freezers, combination refrigerators-freezers, electric heating and heat pumps. In the commercial field the plan called for promotion of electric heating and heat pumps, commercial electric cooking and commercial lighting. High load factor, industrial loads, and industrial electric heating and heat pumps were to be promoted.

Results have been accomplished through sales campaigns. Each campaign had a gimmick.

In a range and water heater campaign, wiring allowances were made. Customers were given gift certificates to purchase window heat pumps.

In all campaigns, dealer salesmen were given bonuses. Cash was put into a "Pot of Gold" for each sale. The salesmen then drew from the pot and could win anywhere from $3 to $25.

In an electric clothes dryer campaign, sales employees and managers put on meetings for the public and demonstrations for civic groups. Electric dryers were set up on the sales floors. Company employees invited their friends to bring their laundry down to the company sales room and run it through the electric washer and dryer. When a customer's laundry was nearly finished, features of the dryer were pointed out to the customer. As a result of this campaign, dryer sales for 1958 were up 80% over 1957.

Window display contests in company offices and dealer stores have been another effective sales tool.

Dealer store open houses have also helped boost appliance sales. Company sales people assist dealers put on these activities when they open a new store, have an anniversary, or a similar celebration. Company auditoriums in the districts are frequently used.

Sales figures tell the effectiveness of the "Target Program." Sales for 1958, compared to 1957, for items promoted in the program were:

Ranges	+52%
Refrigerator-freezers	+40%
Water heaters	+84%
Freezers	+48%
Reverse-cycle heat pumps	+287%
Central residential heat pumps	+286%
Clothes dryers	+80%

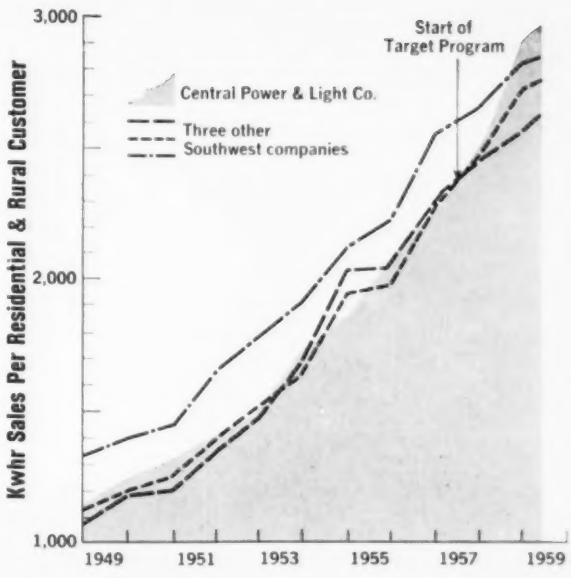
Sales of items not pushed by the promotional activities in 1958, compared to 1957, were:

Refrigerators	+ 9%
TV	−17%
Air conditioners	− 8%
Central air conditioning	−28%

Retail value of appliance sales in the Central Power & Light Co service area increased 11% in 1958 over 1957. At the same time, retail value of appliances nationally were down 11%.

Energy sales have increased from 2,300 kwhr per customer per year for the year ending Jan 1, 1957 to 2,919 kwhr per year for the year ending Dec 31, 1958. Load factor dropped from 64% in 1953 to 54% in 1956. A "target" of 51% load factor in 1961 has been set.

CP&L Vs Three Other Southwest Companies



Preformed™

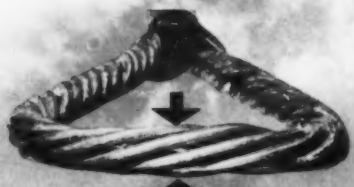
GUY-GRIP dead-ends

STANDARD LOOP

PATENTED — U. S. PATENT NUMBER 2,761,273 TRADE MARK — "GUY-GRIP"

THE SAME WITH A

NEW CABLED LOOP



FOR STRAND SIZES

5/16″

3/8″

7/16″

1/2″

MATERIALS

GALVANIZED STEEL
Utility Grade
High-Strength
Extra-High-Strength

COPPERWELD
Including the
M Series

CALSUN BRONZE

ALUMINIZED STEEL

STAINLESS STEEL

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DEPENDABLE PRODUCT

NEW TWIST

GUY-GRIP dead-ends OFFER YOU:

1 More durable loop... just like the strand

2 Easier tensioning for down-guying & span guying

3 Smoother contouring... more adaptable for multiple guying

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Write for the Preformed Booklet-of-the-month **"THE NEW TWIST"**

NEW

Thermal Plant Simulator simplifies nuclear training

You quickly get the feel of nuclear power plant response with the new Honeywell Thermal Plant Simulator. When used with the Reactor Simulator, it realistically simulates operation of a reactor with a non-boiling coolant *and* a thermal plant with heat exchanger and steam loop.

The Thermal Plant Simulator provides valuable training in thermal loop dynamics . . . simply, safely, economically. To set up a typical atomic power plant program, just plug in prewired connectors that mate appropriate computing networks and instruments. For non-standard programs, an integral general-purpose patchboard permits complete flexibility.

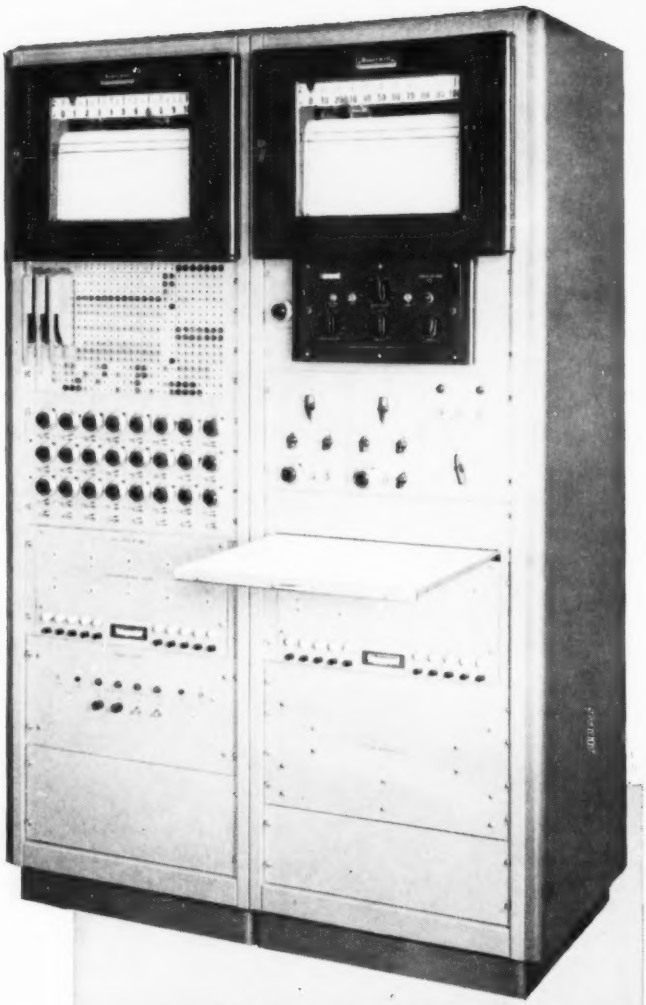
The Thermal Plant Simulator gets reactor flux information directly from the Reactor Simulator, simulates operation of a thermal plant, and feeds back control data to the Reactor Simulator. Together, they permit complete and detailed studies of neutron and thermal dynamics. Thus they provide realistic training that can be duplicated only through operation of an actual nuclear power plant.

To get the full details on either simulators or other products in Honeywell's complete line of nuclear instrumentation, call your nearby Honeywell field engineer . . . he's as near as your telephone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Control*



THERMAL PLANT SIMULATOR has plug-in connectors for typical power plant programs . . . patchboard panel for non-standard programs.

NUCLEAR REACTOR SIMULATOR teams up with Thermal Plant Simulator to provide realistic nuclear power plant training.

The Management Newsletter

Why leave one puzzle in the annual report? It's time to . . .

Clarify Your Financial Statements

Report on **Stockholder Relations**

The high quality of this year's crop of utility annual reports drew special plaudits from the judges of the Reddy Kilowatt Annual Report Contest and inspired a complimentary editorial in EW (June 15, 1959, p. 39). Anyone who looks over a group of them cannot fail to be impressed by the excellence of their presentation—clearly-written narratives, pleasing layouts, interesting and appropriate illustrations. Comparing the 1958 reports with those of ten years ago shows how far the utilities have come with efforts to make their operations comprehensible to the average stockholder.

Only one part of the report seems to be resisting the trend to clarity. This is the section containing the financial statements. There's no question but that the information is there, in the statement of income and balance sheet themselves or the notes which are a part of them. Nor is there any doubt that these statements can be readily understood by accountants and professional analysts—particularly when the annual report is accompanied by a detailed statistical supplement provided by an increasing number of companies.

The question is: Can financial statements be made more informative to a growing number of stockholders whose interest has been whetted by a well-presented report, but who lack the background in accounting necessary to decipher the balance sheet and income statement as they are now presented? The answer is that they probably can. But the way to do it is no small problem.

Here are a few ideas on how utilities might make their financial statements more easily understood by the only-moderately-sophisticated stockholder. They stem from an analysis of 73 of last year's annual reports. These ideas are not proposed for universal adoption, but merely thrown out on the theory that some utilities may wish to consider them as they plan next year's reports.

Analysis of 73 of last year's annual reports shows many differences in the financial statements. On the balance sheet, for instance, 49 companies carry depreciation reserve on the asset side (as a deduction from physical property), while 24 carry it on the liability side, with the effect of increasing both assets and liabilities. Where it is carried makes no difference to a company's financial position, but the lack of uniformity complicates comparisons among companies. For this reason, utilities that now place depreciation reserve on the liability side might consider switching to the majority treatment.

There are also some differences in nomenclature which serve no purpose on a balance sheet for stockholders. The accumulated provision for deferred taxes on account of liberalized depreciation and accelerated amortization is carried by 37 companies as a "reserve for deferred taxes" or similar name. Nine companies call it a "restricted surplus." The others either do not segregate this reserve or surplus on the balance sheet, or else do not make use of the provisions of Sections 167 and 168. Here the lack of uniformity is unavoidable, since some of the state commissions have specified different treatments.

On the income statement, few companies show whether charges for deferred taxes stem from liberalized depreciation, accelerated amortization, or both. Although detailed explanation is usually made in the footnotes, it would seem that these charges could be segregated right in the tabular portion of the statement, making it possible to get a true picture without turning the page and reading fine print.

Adjustments resulting from construction activities sometimes cause confusion as they are now reported. Most utilities credit income with "interest during construction," usually including it as a credit under the sub-heading "Income Deductions." Where a company has expanded very rapidly in one year, and then greatly reduced expansion in the next year, the change in this credit can affect the net income comparison materially. In some cases, a year-to-year decline in income of 10% to 15% has been accounted for entirely by a cut in the interest during construction credit. With this important item buried under

income deductions, it is doubtful whether many stockholders will appreciate its impact or understand what has happened to earnings.

Another item which may affect earnings comparisons, but which has so far been noted on few, if any, utility income statements is the amount of wages of permanent employees allocated to the time spent by them on construction matters and added to the cost of the projects. This amount is not included in the portion of wages charged to income, and the latter amount may be materially reduced. Like interest during construction, this item may fluctuate widely from year to year as construction swells or diminishes. The two items combined can easily make the difference between an increase in net income and a substantial decline in year-to-year comparisons. In the interest of clarity, utilities may wish to consider segregating both items on the income statement.

Utilities differ about where to end the income statement. Most companies cut it off after "Net Income," but a growing minority add a few lines below to show preferred stock dividends accrued, the remainder of earnings applicable to common stock, and the earnings per common share. This reduces the chance that stockholders reading the income statement will jump to the erroneous conclusion that "net income" is synonymous with "earnings applicable to common stock," striking one more small blow for clarity.

About one-third of utilities studied combine income and surplus statements on the same page, but the other two-thirds separate them. One reason why separate presentation of the two statements might be more desirable is that it permits the inclusion of preferred dividends, balance for common, and per-share earnings. This is impossible if the net income is run directly into the surplus statement. A second reason for separating the surplus statement from the income statement is simply to avoid confusing the two. Where they are combined, the last figure in the entire statement is not "net income" at all, but "earned surplus" (or "retained earnings", as it is called by an increasing number of companies). There is a real danger that stockholders examining the statements casually may assume that the last figure is net income for the year without bothering to read the label.

Evidence that this is not mere fantasy is provided by the following true story. Several years ago the management of a large holding company system spent 45 minutes puzzling over the combined income and surplus statement of one of the subsidiary companies. A cursory look and the habits of years of financial work led them to the incorrect assumption that the subsidiary's "earned surplus at end of period" (shown on the bottom line of the statement) was its "net income" for the period. Quite a discussion ensued as to the fact that earnings did not seem to be correct. The error was discovered, of course, but here it was natural that the matter would be run down until someone found what was wrong. On the other hand, stockholders glancing at such a combined statement none too carefully and making the same erroneous assumption would be unlikely to correct it.

These are just a few examples of how utilities might clarify their financial statements. Others include definitions of the charges—either directly on the statement or on the facing page—and footnotes written in less technical language and printed in type that can be read without squinting. These suggestions are not offered as gospel, but in the hope that kicking them around may stimulate improvements in the one section of utilities' annual reports which still baffles many stockholders.

For a look at one way a utility might present its Income Statement, turn the page

Below is a sample statement of income incorporating several of these ideas. This statement is purely hypothetical, and was deliberately constructed so as to bring out the points mentioned in the article. Only the tabular portion is shown, but the complete statement would also include footnotes. Since no common stock was sold during the year, the statement reports the number of shares outstanding at end of period. If new common had been sold, average number of shares outstanding would have been reported instead.

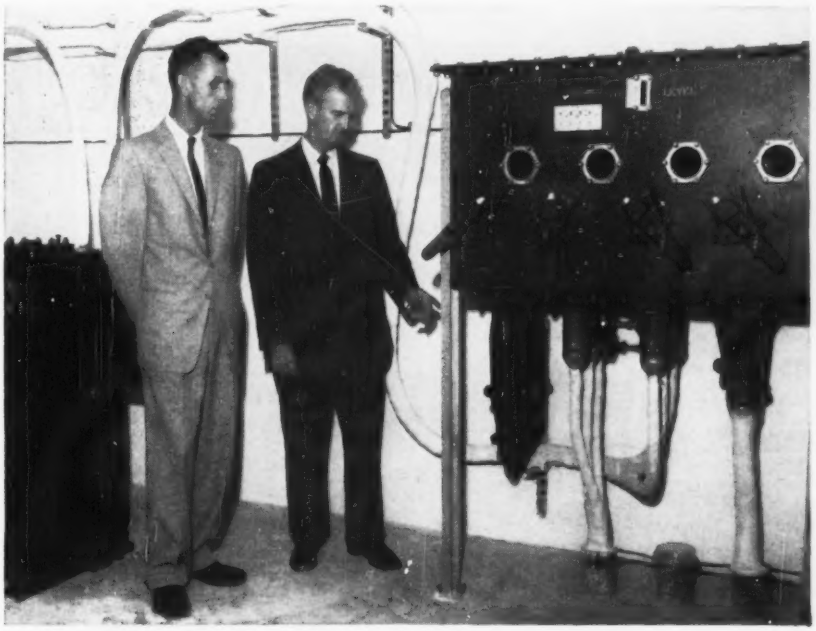
STATEMENT OF INCOME
(Years Ended December 31, 1958 and 1957)

	(Thousands) 1958	1957
Operating Revenues (What we collected from customers)	$20,000	$18,000
Operating Costs (What we spent for running business):		
Wages	4,000	3,700
Taxes (except income taxes)	1,500	1,400
Other Operating Expenses	3,000	2,800
Maintenance	1,000	900
Depreciation	2,000	1,800
Total	11,500	10,600
Operating Income (before income taxes)	8,500	7,400
Income Taxes and Provision for Future Income Taxes:		
Federal Income Taxes	3,300	2,825
State Income Taxes	200	175
Set aside for Future Income Taxes:		
Accelerated Amortization	200	180
Liberalized Depreciation	320	290
Total	4,020	3,470
Operating Income (after all taxes)	4,480	3,930
Other Income	100	100
Gross Income (before costs of borrowed capital)	4,580	4,030
Income Deductions:		
Interest on Bonds	1,600	1,500
Interest on Debentures	100	100
Adjustments in Costs of Borrowing (Amortization of premium and/or discount and other expenses of selling securities)	50	50
Interest on Bank Loans, etc	50	50
Other Income Deductions	50	50
Total	1,850	1,750
Net Income (before adjustments for construction)	2,730	2,280
Additions to Income for Construction in Progress:		
Interest during Construction (Cost of capital for facilities not yet completed)	200	800
Wages for Construction (Portion of wages of permanent employees applicable to work on facilities not yet completed)	150	700
Total	350	1,500
Net Income	3,080	3,780
Dividends on Preferred Stock	500	500
Balance of Income Earned for Common Stockholders	**$2,580**	**$3,280**
Number of Common Shares Outstanding (end of period)	1,000	1,000
Earnings per Common Share	**$2.58**	**$3.28**

PORT OF SAN DIEGO UNDERGROUND DISTRIBUTION SYSTEM PLANNED FOR FLEXIBLE, DEPENDABLE SERVICE AND EASE OF EXPANSION

Continuity of power service at the Port of San Diego 10th Ave. Terminal is a "must." An extensive array of material handling equipment will serve the warehouse as well as rail and truck transportation required to load and unload nine ocean-going freighters simultaneously. Adequate provisions have been made to maintain continuous electrical service for the 2600-foot wharf even when the need occurs for expanding its present facilities.

Sound planning included two lines of service to each transformer through the use of twenty-six submersible G&W 3-pole, 15 kv, 400 ampere load break oil switches. Two types were used. The Type RAL is a 3-way unit serving the function of three separate switches—1) a loop-through, 2) an isolating and 3) a double throw switch. The Type RAM is a 4-way unit that permits variable combinations of feeders and loads by tying to the switch bus through individual load break disconnects. Stud bushing compartments on the switches make system expansion possible without interruption of power service. There is a G&W load break oil switch to solve your problem. A G&W representative will be glad to tell you about them or send for the new switch folder for additional information.



J. E. Liebmann, Harbor Engr. (left) and Willis Lipscomb, Design Engr., point out stud bushing compartments on G&W Type RAM switch. These compartments permit connection of additional cables without taking the switch out of service, thus avoiding an outage.

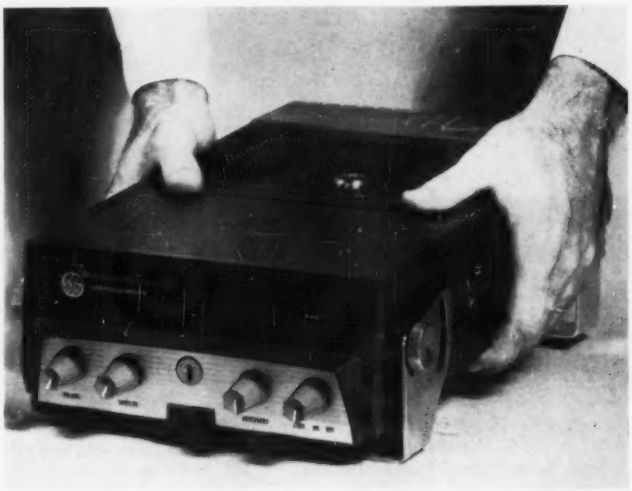
G&W ELECTRIC SPECIALTY COMPANY

3500 West 127th Street, Blue Island, Illinois

Representatives in principal cities • Canadian Mfr.—Powerlite Devices, Ltd., Toronto

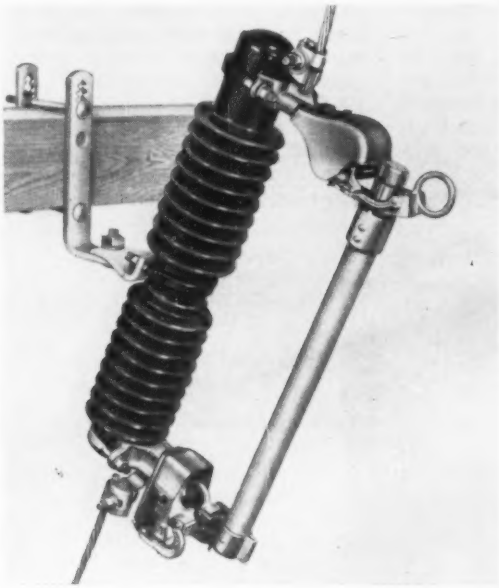
(For further information refer to Reader Service on page 86)

Mobile Radio . . .



. . . has battery drain of only 0.04 amp in the standby position. This is no larger than that of the vehicle's clock. The GE Transistorized Progress Line features units as large as 75 w. Also available are 30 and 10-w units in sizes as small as 8⅝ in. wide, 12 in. long, and 4 in. high. The 75-w model, most powerful transistor mobile radio on the market, has only four vacuum tubes.

General Electric Co, Communications Products Dept, Lynchburg, Va.

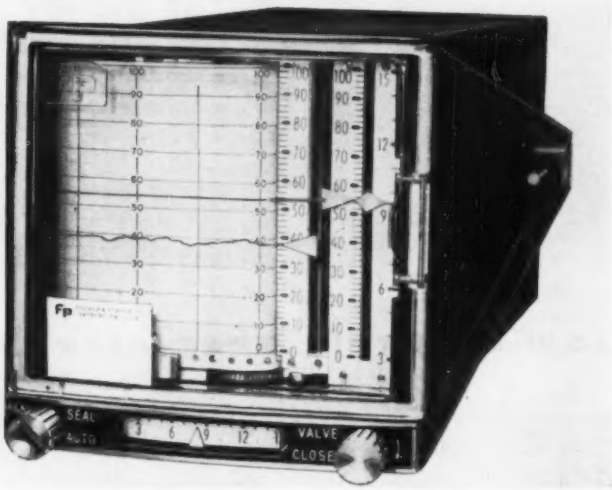


Open-Type Cutout . . .

. . . of 27-kv rating has been added to the Type "F2" cutout series. The drop-out cutout meets all applicable NEMA standards. It is available in 100-amp normal-duty and heavy-duty models and features a maximum interrupting capacity of 4,000 RMS amp. Normal and heavy-duty models are identical except that the heavy-duty rating is supplied with an expendable cap, and the normal-duty rating has a solid cap. Conversion from one rating to another is accomplished by simply changing caps.

A. B. Chance Co, Centralia, Mo.

Strip Chart Recorder . . .



. . . and recorder controller feature a modified inking system that provides a full month's record without refill. Known as the Mark III line, the instruments also feature a flip switch for reversing controller action from air to open to air to close. Other characteristics include interchangeability of indicating and recording chassis and a 14-hr visible chart record.

Fischer & Porter Co, 143 Jacksonville Rd, Hatboro, Pa.

(*More New Equipment on page* 86)

When "GOOD ENOUGH" isn't enough

use TRIANGLE CONTROL CABLE

Failure in a control cable is a messy business. The fault is hard to find, and operations must stop until it *is* found. That's why contractors and engineers don't use just a "good enough" cable is those vital links—they want the best. Many now guarantee this by specifying and using Triangle Control Cable.

But, there is no such thing as *one* all-purpose control cable construction. That's why Triangle makes these five general types—each designed for a particular set of circumstances:

1. **Rubber insulated, braid covered**
2. **Rubber insulated, Trioprene sheath**
3. **Rubber insulated, lead sheath**
4. **Trioseal insulated, Trioseal sheath**
5. **Triolene insulated, Trioseal sheath**

These are available in conductor sizes 14 to 9 with 1 to 37 conductors. Special types to meet unusual conditions are made to specifications. Types of control cable are available for aerial, conduit, tray, underground duct and direct burial installations.

Informative technical literature is yours for the asking.
Write for your copy of our Control Cable Bulletin.

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

"It MUST Be Right!"

Readers Service

For additional information on new products, supplies, and services in this issue, the manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

GE .....Mobile Radio ☐
Chance .....Cutout ☐
Fischer & Porter .....Recorder ☐
Preformed .....Dead-End ☐
Boyer-Campbell .....Safety Hats ☐
Chapman .....Bandage Maker ☐
Penn-Union .....Connector Line ☐
L-M .....Luminaire Heads ☐
Malleable Iron .....Clevis ☐
Auburn .....Trencher ☐
Husted .....Wire Support ☐
Thermo Electric .....Instruments ☐
GE .....Lamps ☐

OTHER

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

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Trial ..... ☐
Specs ..... ☐
Purchase ..... ☐

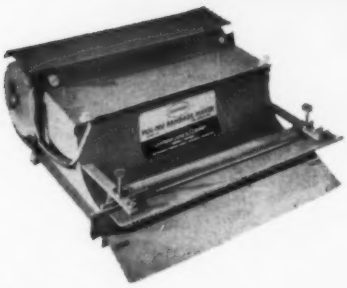
JULY 6, 1959

Dead-End . . .

. . . has reduced overall width and cabled diameter of the loop. Smoother contouring permits the bend of the loop to be better seated in the hardware groove. "Cabled Loop" Guy-Grip dead-ends are available for use at top, breaker and anchor rod in $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$ and ½-in. diameter sizes in materials homogeneous with the strand for which they are designed: Galvanized Steel (Utility Grade, High-Strength, and Extra High Strength); Copperweld (including the M Series); Calson Bronze; Aluminized Steel; Stainless Steel; and Alumoweld.
Preformed Line Products Co, 5349 St. Clair Ave, Cleveland 3, Ohio.

Safety Hats . . .

. . . feature polyethylene suspension including lock-straps which assure minimum 1¼-in. clearance between crown and hat shell, but maintain adjustment provisions for comfortable crown depth fit. A plastic-zippered leather or leatherette sweatband may be replaced quickly, without replacing or disturbing any part of the suspension.
Boyer-Campbell Div, White Sewing Machine Corp, 6540 St. Antoine St, Detroit 2, Mich.

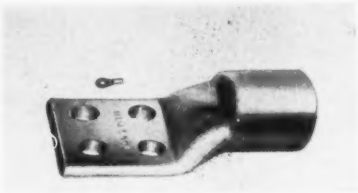


Bandage Maker . . .

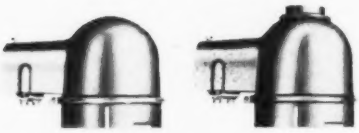
. . . has added features. Developments in the improved Pol-Nu bandage maker include a spindle rod and brackets for feeding 300-ft rolls of polycraft into the device, a removable top to keep trash from falling in the hopper, and rope handles for carrying the machine.
Chapman Chemical Co, Box 138, Memphis 1, Tenn.

Crimp Connector . . .

. . . line has been completed to include all sizes from No. 22 to 2,000 Mcm. In addition to all types of



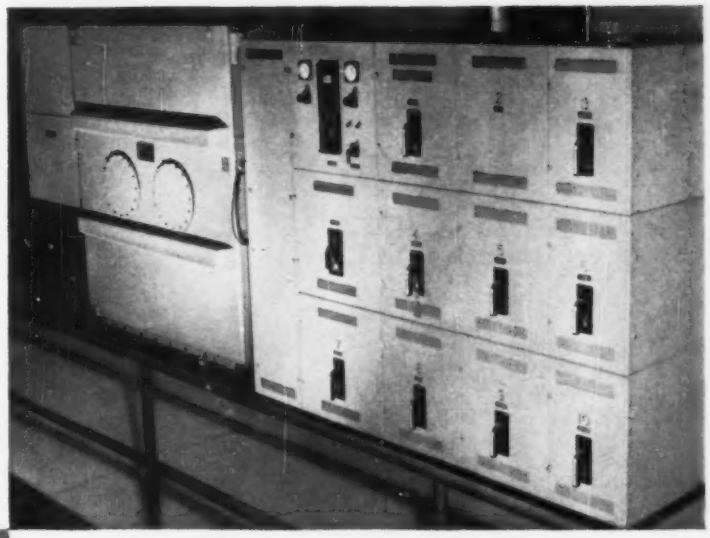
lugs, the enlarged line includes parallel and butt splices, pigtails and tags. Penn-Crimps are furnished with color-coded insulation, withou without insulation grip.
Penn-Union Electric Corp, Erie, Pa.



Luminaire Heads . . .

. . . are rotatable, permitting 360-deg orientation of an optical assembly. Features of the Model A14 heads include standard bail hatch mounting ears, a clamping band that

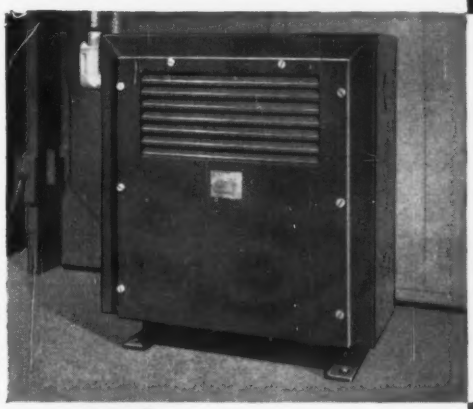
(*Continued on page* 88)



Wagner

SEALED DRY-TYPE TRANSFORMERS

These modern unit substation transformers can be safely installed in any load-center—any place—because they are hermetically sealed in welded steel cases to provide positive protection from contamination, fire and explosion hazards. The only maintenance needed is periodic checking of gas pressure (inert nitrogen), case and bushings.



Here's Reliable Power

for your plant electrical system

WAGNER LOAD-CENTER TRANSFORMERS

Wagner

INDOOR DRY-TYPE TRANSFORMERS

These new quiet-type transformers are compact, light in weight, provide a flexible, modern power system to change higher voltage distribution service to lower voltage lighting and power circuits. They meet all safety requirements for indoor installation.

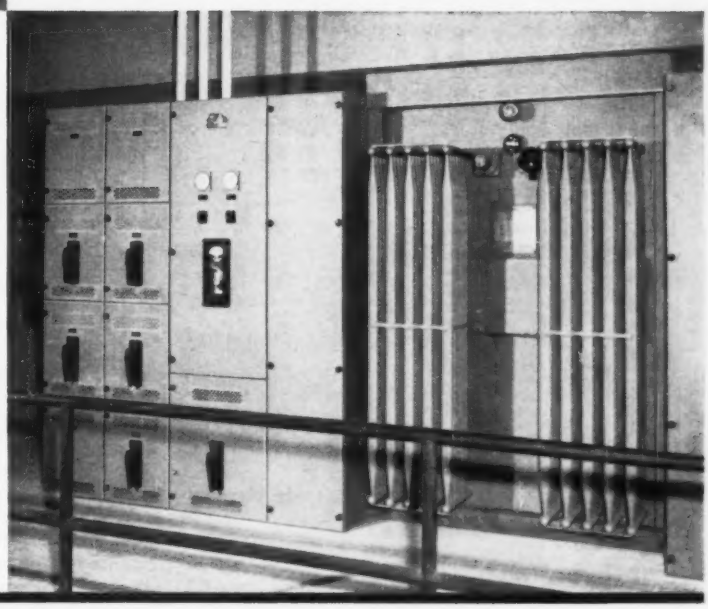
Wagner

NOFLAMOL TRANSFORMERS

Non-inflammable liquid filled. For indoor or outdoor installation. Close-coupled design fits flush against switchgear enclosures, to eliminate and save space. Throat-connected designs are also available.

Bulletins TU-205 and TU-214 give full information on Wagner Load-Center Transformers. Write today.

WT59-2



BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6456 Plymouth Ave., St. Louis 14, Missouri.

SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL* . . . *AUTOMOTIVE*

Luminaire Heads . . .

(*Continued from page* 86)

facilitates rotation, and a slip fitter for mounting 1¼-in. pipe. The aluminum heads are available with or without a photoelectric control adapter.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

Thimble Clevis . . .

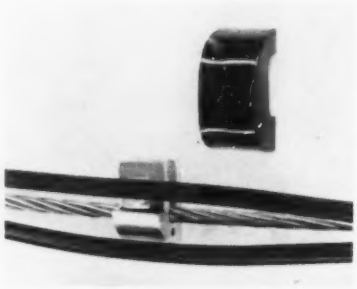
. . . is designed for dead-ending wire or strand to suspension insulators or eye-type fittings. It is also used for dead-ending aerial cable messenger. A 2¼-in. thimble diameter maintains the shape of the strand, and the tie bar will accommodate a hook for stringing and tensioning operations. Strand diameters up to ⅞ in. can be used.

Malleable Iron Fittings Co, Branford, Conn.

Trencher . . .

. . . fits on International Harvester 340 and 460 tractors. The Auburn Gear-Draulic Trencher will trench at widths from 6 to 14 in. and depths up to 6 ft. It reputedly will dig up to 800 ft of trench per hr. The trencher has a forward propulsion drive which slows the tractor's speeds from miles per hour to feet per hour for more efficient digging.

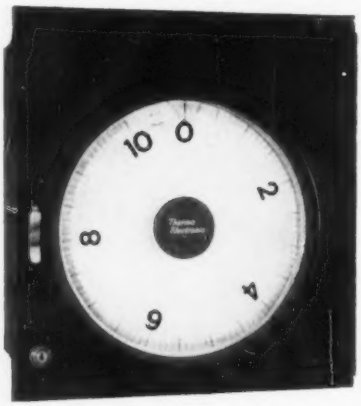
Auburn Machine Works, Inc, Auburn, Neb.



Wire Support . . .

. . . for Triplex cable fastens neutral to pole. A ¼-in. hole passing through the support allows a pole ground to be taken from either side. A ⅜-in. transverse tapped hole, with a slotted head screw for holding the individual ground, is optional. The support requires no tie wires and will take 1/0 to 3/0 ACSR inclusive.

Husted Electrical Mfg Co, Gibsonia, Pa.



Instruments . . .

. . . can indicate and control any variable that can be converted into an electrical quantity. The two electronic instruments are of the self-balancing potentiometer and bridge types. They feature a high-gain servo-amplifier.

Thermo Electric Co, Saddle Brook, N. J.

Quartz Lamps . . .

. . . never grow dim throughout their life. Available first in 500 and 1,500-w sizes, the "Quartzline" lamps use a repeating iodine cycle principle to eliminate blackening. The designs provide lamps up to two hundred times smaller than present lamps of the same wattage.

General Electric Co, Nela Park, Cleveland 12, Ohio.

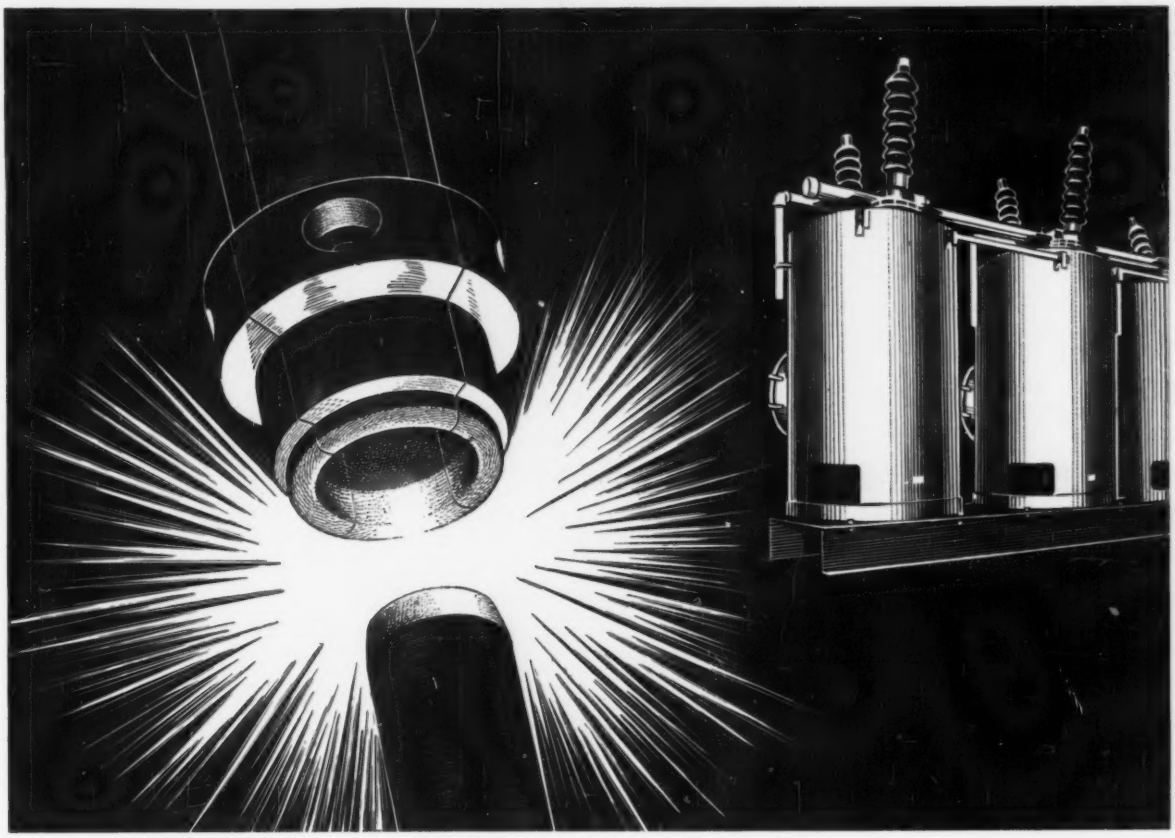
More New Products

Portable, all-band **frequency and deviation meter** services two-way radios. Called Model T-1020A, it provides variable signal measurement and generation from 20 to 1,000 Mc with ± 0.0001% accuracy.—Motorola, Inc, 4501 W Augusta Blvd, Chicago 51, Ill.

Compact **charging package** for electric hand trucks provides automatic self-contained charging. The "Fulpowr" charger is available in single-phase 120 or 240-v, 60-cycle ac service that can be plugged into any standard outlet. — Gould-National Batteries, Trenton, N. J.

Disposable clothing is fire-resistant and water-repellent. Shirts, pants, laboratory coats, hats, boots, aprons and gowns are available.—General Scientific Equipment Co, 7516 Limekiln Pike, Philadelphia 50, Pa.

Reversible industrial **safety mitt** has extra thumb tucked into hand pad across knuckles. Of Kelnit "Iron-Kore" fabric, the mitt is reversed when one side becomes worn.—Keller Glove Mfg Co, Plumsteadville, Pa.



Be Sure of Service By Specifying Elkonite® Contacts

There's a difference in contact materials . . . and the difference means a lot in the service you get from the equipment you buy. Extra performance in repeated making and breaking high-current circuits, in voltage regulators, circuit breakers, motor controllers and similar equipment, demands extra know-how in the development and manufacturing of contacts.

And that's what you get with Mallory Elkonite® contacts. These unique materials are the result of long experience by Mallory in applying special powder metallurgy techniques to combine refractory and conductive metals. For each circuit-breaking application, our contact specialists can control such factors as refractory particle size and methods of pressing and sintering to produce the optimum combination of hardness, strength, density, arc erosion resistance and electrical conductivity for the intended use.

Leading manufacturers have been using Elkonite® for many years, because they know the extra value and performance that Mallory engineers into them.

To make sure that your switchgear gives you top service, tell your supplier you want Elkonite® contacts.

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Tuning Devices • Vibrators
Electrochemical—Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical—Contacts • Special Metals • Welding Materials

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

Black and Hicks Named VPs at Tampa Electric

Fischer S. Black and James D. Hicks have been named vice presidents of Tampa Electric Co. Black will be vice president, administrative, and Hicks will be vice president, operations. Joseph E. Burris, assistant superintendent of operations, has been made general superintendent.

Black has been editor of Electrical World since 1948, and editor and publisher since 1954. Before joining EW he was with Potomac Electric Power Co as assistant to the president. He started with PEPCO in 1934 as a cadet engineer in the dc-ac changeover department.

In 1942, Black became assistant system planning engineer, and became assistant to the president in 1946.

He has also worked for the Nantahala Power & Light Co, Tidewater Power Co and Tallahassee Power Co.

BLACK

HICKS

He holds a BS in electrical engineering, an LLB, and a Master of Patent Law.

Hicks has been with Tampa Electric since 1939. He was first employed as a groundman in the transmission department, gained power plant experience, then worked in substation maintenance.

In 1945 he became substation maintenance foreman. He then became assistant transmission superintendent and later transmission superintendent. Earlier this year he was promoted to general superintendent of operations.

Logan Made VP at New Jersey Utilities

John E. Logan has been elected vice president, engineering and generation for Jersey Central Power & Light Co and New Jersey Power & Light Co.

Logan joined Jersey Central Power & Light in 1934 as an assistant relay engineer. He then became assistant general superintendent, assistant chief engineer, and manager of power supply.

In January, 1957 he was named assistant vice president of engineering and generation for both companies.

A graduate of Massachusetts Institute of Technology with a BS degree in electrical engineering, he is a member of the American Institute of Electrical Engineers.

Bradshaw Named Vice President, Sales

L. O. Bradshaw, manager of Mississippi Power & Light Co's department of marketing and development, has been elected vice president, sales. He has been with MP&L for 13 years.

He joined the company as an agricultural engineer at Cleveland. In 1948 he was promoted to industrial engineer and transferred to Jackson and became manager of the agricultural and industrial section in 1950.

(*More News About People on p* 92)

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors: URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Aluminum Conductors: Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	**230**	105	**87.4**
4	155	170	163	**143**	73.3	**53.3**
6	103	115	108	**91.5**	51.5	**35.0**
Solid						
2	239	260	232	**219**	92.2	**79.2**
4	151	164	152	**136**	64.0	**48.0**
6	100	112	101	**87**	45.7	**31.7**

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean . . . free-stripping . . . has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits . . . when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous . . . tough . . . resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene . . . The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

U. S. Industrial Chemicals Co.
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99 Park Ave., New York 16, N. Y.

Please send me:
☐ "Polyethylene . . . The Best Line Wire Covering"
☐ "PETROTHENE Resins for the Wire and Cable Industry"

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Company:_____

Address:_____

City:_____ State:_____

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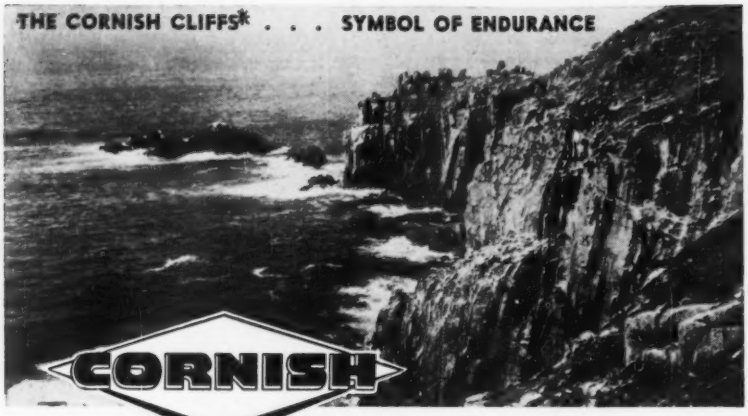
Branches in principal cities

THE CORNISH CLIFFS* . . . SYMBOL OF ENDURANCE



also symbolizes reliability in electric cords and cord sets

"MADE BY ENGINEERS FOR ENGINEERS"

BLUE CHIP products . . . custom-made for the leaders in the industry . . . dependable for consistent performance and ultimate economy

CONSULTATION WITHOUT OBLIGATION

* The Cornish Cliffs at Land's End, Cornwall, England
Photo Courtesy of British Information Services

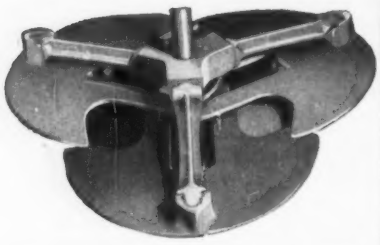
CORNISH WIRE CO., INC.
50 Church Street New York 7, N. Y.

H. K. Porter Names Hallman Division Sales Manager

H. K. Porter Company Inc has appointed William Hallam sales manager of its National Electric Division.

Formerly district sales manager in St. Paul, Minn., Hallam joined the company in June, 1958. Prior to that he was vice president of Moock Electric Supply Co, Canton, O. He has also held a sales engineering post with Westinghouse Electric Supply Corp.

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



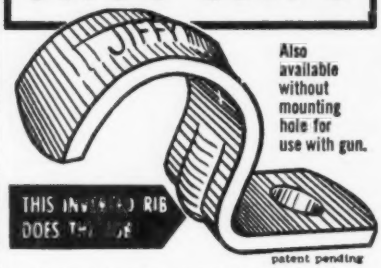
EVERSTICK ANCHORS

For new construction and maintenance — Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resiliant, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Two New Minerallac Quality Products Designed for Jobs Too Heavy for Standard Jiffy Clips

MINERALLAC Heavy Duty AND Medium JIFFY CLIPS



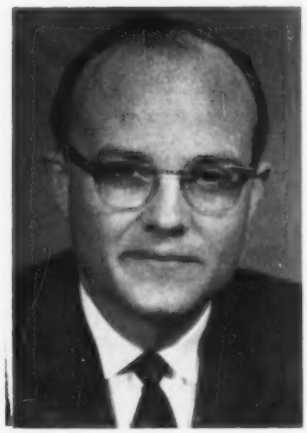
Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

Order From Your Electrical Wholesaler

SEND FOR LITERATURE
MINERALLAC ELECTRIC COMPANY
25 North Peoria St. Chicago 7, Ill.

MINERALLAC



Electric Council of NE Names New Director

Charles R. Bragg has been named executive director of the Electric Council of New England, succeeding Capt. Henry A. Ingram.

Bragg had been managing director of the Home Builders Assn of Greater Boston.

Keller Elected Executive VP at Holophane

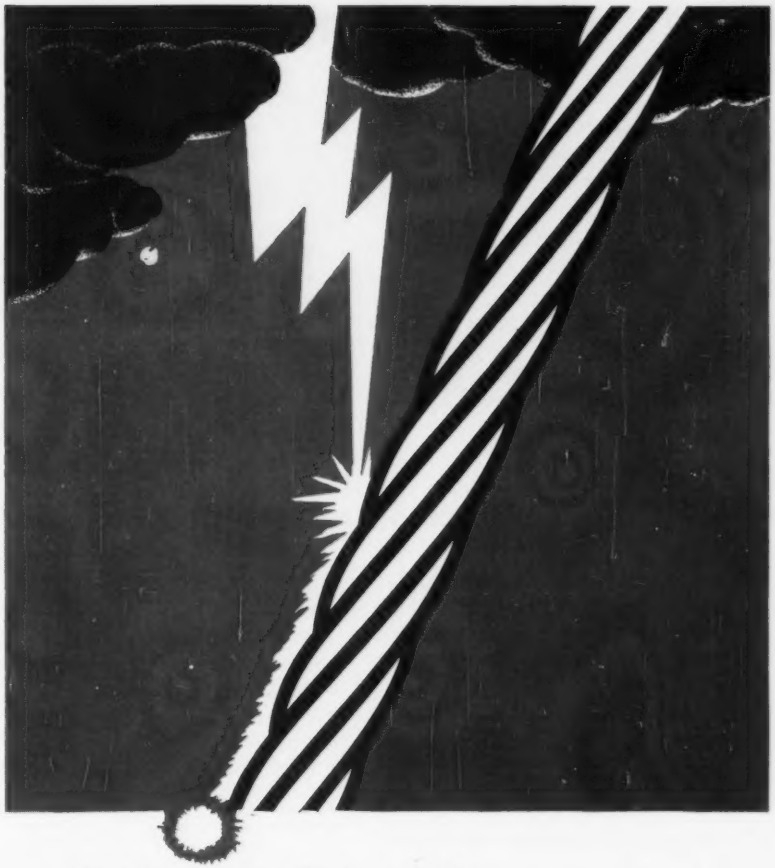
Holophane Co, Inc has elected Clarence C. Keller executive vice president. He became associated with Holophane in 1929, first as a test engineer, then advancing to manager of application engineering, sales manager, vice president in charge of sales and director of the parent company and two subsidiaries.

Renouard Elected VP at Anaconda

Edward I. Renouard has been elected vice president in charge of western operations of The Anaconda Co. Renouard, who had been manager of mines since 1952, succeeds Chester H. Steele who died recently.

Other positions for Renouard included assistant general and general superintendent of mines.

(*More News About People, p* 94)



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The CF&I Image—a giant steelman—stands for the dependability that's built into all CF&I steel products. One of them—Galvanized Steel Strand—is a safe, sure way to ground electrical installations and equipment.

Available in seven- or three-wire constructions, CF&I Galvanized Steel Strand is made in accordance with ASTM Specifications A-122 or A-363. In addition, it can be produced to *your particular specifications.*

CF&I Galvanized Steel Strand is also recommended for guy and messenger wire, and is available for quick delivery either from a nearby CF&I warehouse or from your local electrical distributor.

6931

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THE COLORADO FUEL AND IRON CORPORATION

In the West: THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise Butte • Denver • El Paso • Farmington (N. M.) • Ft. Worth • Houston Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City Phoenix • Portland • Pueblo • Salt Lake City • San Francisco San Leandro • Seattle • Spokane • Wichita

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CF&I OFFICE IN CANADA: Montreal

CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Vancouver • Winnipeg

Remington Rand Appoints Schnackel VP

Jay W. Schnackel has been appointed vice president of Remington Rand Division of Sperry Rand Corp in an over-all staff position in the company's Univac Tabulating Division.

Schnackel was previously vice president for manufacturing services of International Business Machines Corp. He joined IBM as a Cleveland sales representative in 1937 and later became branch manager. Other positions were controller and assistant general manager of the Poughkeepsie, N. Y., plant, general manager of the Endicott Plant, and vice president for manufacturing.

Power Project Superintendent Named

E. L. Gochnauer has been named power plant superintendent for the new Niagara project of the New York State Power Authority.

He worked on the construction of Grand Coulee Dam in 1935 and 1936, and after serving with the Army Engineers at the Fort Peck project, returned to Grand Coulee in 1939 to take charge of maintenance engineering.

In 1950 he went to Anderson Ranch Dam in Idaho as chief electrical engineer and then to Hungry Horse Dam near Columbia Falls, Mont., as chief electrical and mechanical engineer. He was later made superintendent.

PERSONAL BRIEFS

Wilmer P. Holben has been appointed distribution consultant by Sao Paulo Light Co, subsidiary of Brazilian Traction, Light & Power Co. Holben was formerly distribution engineer at Duquesne Light Co, Pittsburgh, Pa.

Walt Woirol has been named to the newly created post of treasurer of the Chelan County (Wash.) Public Utility District. He was formerly the controller.

William R. Kollmayr, division sales manager of New Jersey Power & Light Co, has been elected chairman of the Farm Electrification Council of New Jersey.

Stanley J. Brown has been appointed Sales Manager of Wasley Products Inc's lighting fixture division for the midwestern and western areas.

Philco Corp has promoted three research scientists: **Chester P. Woodward** to assistant director of research; **Dr. Robert B. Goldman** to manager of sensory and data handling systems; and **Stanley Zebrowitz** to manager of military communications research.

Clement E. Sutton has been named manager of marketing in General Electric Co's gas turbine department. Sutton had served as manager of marketing for the company's apparatus service shops department. He succeeds **Edward G. Naylor** who has been named to the newly created post of manager of plant subcontracting operations in the Schenectady, N. Y. public and employee relations department.

Stone & Webster Engineering Corp has named **Howard E. Marx** to supervise construction of Project EHV near Pittsfield, Mass. **M. H. Cutler** has been named engineering manager.

Westinghouse Electric Corp has appointed **Frank N. Hubley** as its project supervisor for the installation of the waterwheel generators at the Lewiston Power Plant of the Niagara Power Project. **Dr. Woodrow E. Johnson** has been appointed director of projects for the atomic power department.

John Edward Kenney, executive vice president and general sales manager of Foster Wheeler Corp, has been named to the board of directors.

Ralph A. Castillo has been appointed general manager of Joseph T. Ryerson & Son, Inc. in Houston, Tex.

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NOrmandy 8-7778

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OBITUARY

Richard D. Fox, 62, superintendent of the underground department for the Georgia Power Co . . . **Thomas A. Purton,** 70, retired chief engineer for Utah Power & Light Co . . . **Russell H. Goodrich,** 64, assistant to the vice president for production of Indianapolis Power & Light Co . . . **John Earl Atkinson,** 77, retired Bonneville Power Administration executive . . . **Richard J. Beamish, Jr,** former assistant to the administrator of the Rural Electrification Administration and Western District manager for Tennessee Valley Authority . . . **H. G. Greenamyre,** 54, Consumers Public Power District's first vice president.

Martin Frisch, 59, vice president and director of advanced engineering for the Foster Wheeler Corp. . . **Walter D. Wood,** 47, manager of field-finance planning at General Electric Co's Appliance Park . . . **Carl Folke Norberg,** 60, president, Electric Storage Battery.

Reduce Noise Levels

(*Continued from page* 63)

radiation R_a in Figs. 1 & 2.

If a compliant element is placed on the inside wall of a transformer, and the force generator is acting on the core side of the compliance, we have a circuit such as Fig. 3. In this case the sound radiation mesh is shunted with a compliance, and an element containing as little stiffness as possible would have best results. Evidence indicates that different transformers have force generators acting at different points within them. A compliant element on one side of a transformer in some instances reduces radiated noise on one or more of the other sides.

Fig. 4 provides experimental data of noise reductions obtained by the use of different compliant elements. The elements proposed are metallic and offer no new materials to transformer users. It may be seen from the data that additional experimentation will be necessary to obtain sizeable noise reductions.

Under no circumstances is this to be construed as an offering of these securities for sale, or as an offer to buy, or as a solicitation of an offer to buy any such securities. The offer is made only by means of the Offering Circular.

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Multi-Amp Electronic Corporation

Common Stock
($.10 Par Value)

Price $3.00 a Share

Copies of the Offering Circular may be obtained from the undersigned.

Underwriter

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P-2021 Electrical World
Class. Adv. Div.,
P. O. Box 12, N. Y. 36, N. Y.

PUBLIC UTILITY RATE MAN

Excellent opportunity with consulting firm. Prefer age 35-45, engineering graduate, with electric and/or gas utility experience. State regulatory commission experience would help. Salary depends upon age, experience, previous earnings and capacity. Job requires travel. Send complete resume with photograph to P. J. Fallon, Middle West Service Company, Consulting Management Engineers, 20 North Wacker Drive, Chicago 6, Illinois.

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NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

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Relay And Meter Test Engineer. Graduate EE with minimum 6 years experience meter and relay testing and relay coordination with operating utility. Must calculate system short-circuit conditions, prepare relay coordination curves, test and adjust relays, test and adjust watthour meters and perform general system testing and trouble shooting for small but fast-growing utility in Middle East. Ability organize test section, formulate test procedures, train test personnel and specify operating and test equipment is essential. Carrier system and two-way radio experience desirable but not essential. Salary $16,000 to $17,000 with two-year contract and other benefits. P-1838, Electrical World.

Systems Specialist—Nationally-known management consulting organization needs man with BBA or BS in accounting to work with clients throughout U.S.A. and Canada. Minimum of 3 years experience in public utility accounting and/or systems methods and procedures required. Send resume and salary requirement in first letter. Replies confidential. P-2053, Electrical World.

Assistant Chief Power Plant: Man under forty (40) with technical education and power station experience. Must have working knowledge of turbo-generators, boilers, pumps, combustion control and switchgear. Opportunity to advance. Location—Midsouth. Give all information and salary requirement in first reply. P-2051, Electrical World.

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TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
4	1667	Mol.	69,000–34,500
3	833	West.	66,000–6900/11950
3	500	G.E.	66,000/33,000–2300/13200
3	500	Wagner	69,000–460
4	333	West.	67,000–7200
1	2500	Mol.	44,000–2400/4160, 3 Ph.
2	2500	Wagner	45,800/22,900–4160Y, 3 Ph.
3	500	G.E.	44,000–2400/4160
3	200	West.	44,000–480
1	5000	West.	34,500–13750/6875, 3 Ph.
1	3750	G.E.	34,400–13800/7960, 3 Ph.
2	3000	Upgf.	34,750–4160, 3 Ph.
2	1500	G.E.	34,400–2520, 3 Ph.
3	1000	A.C.	34,650/11,500–2300
3	500	Mol.	34,500–2300/4600
3	200	A.C.	34,500–2400/7200/12470Y
2	2500	Wagner	22,900–4160/2400, 3 Ph.
2	1500	G.E.	23,000–2400/4800, 3 Ph.
1	7500	A.C.	13,800–2400, 3 Ph.
2	3000	G.E.	13,800–2640, 3 Ph.
1	2500	G.E.	13,800–2400, Unit Sub
3	667	Kuhl.	13,800–480
1	600	Stand.	13,200–2300, 3 Ph.
1	450	Penna.	13,200–2400, 3 Ph. Askarel
3	333	G.E.	13,200/22800Y–2420/4190Y
3	333	Mol.	7200/12470–2400/4160
3	125	A.C.	6900–2300
3	100	G.E.	4800–120/240
3	400	G.E.	2300/4000–230/460
3	100	G.E.	2300/4000–230/460

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1	500	G.E.	694A. 4160 V. 3 Ph STEP
1	375	G.E.	50.2A. 34500 V. 3 Ph STEP
1	250	A.C.	601 A. 2400 V. 3 Ph STEP
3	96	G.E.	200/400 A., 2400 V. 1 Ph IND
8	36	West.	150/300 A., 2400 V. 1 Ph IND.

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3—1000 kva, West. 1/13800/480
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P-2023 • Electrical World, 68 Post St., San Francisco 4, Calif.

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Require man experienced in designing conduit plans, cable systems, physical layouts, wiring diagrams, lighting systems, and other electrical features of hydroelectric powerplant design. Board work. Send resume to Mr. James E. Collins, Personnel Manager.

HARZA ENGINEERING COMPANY
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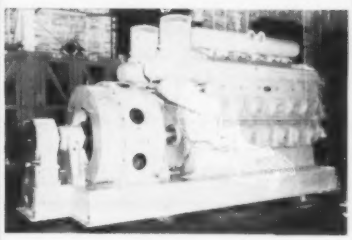
Big Savings from Manufacturer's price

750kw GM DIESEL ENGINE GENERATOR SETS



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Representative wanted for manufacturer of street lighting equipment, pole line specialties. Full particulars. RW-9821, Electrical World.

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4—2500 KVA W-H 34500—2400/4800/1000
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4—1000 KVA Mol. 7200/12470Y—4160
3—333 KVA A-Ch. 2400—240x480
3—333 KVA W-H 67000/69000—240x480
3—400 KVA W-H 11500—2400/4800
6—167 KVA G-E 7200—2400/4160Y
6—150 KVA G-E 7200—240/480
6—150 KVA G-E 2400—120/240
1—750/938 KVA G-E 3-Ph. 3300—6900Y TCUL equip. fan cooling
1—1000 KVA W-H 3-Ph. 33000—7200Y TCUL equipped.

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
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47 Years' Dependable Service

The Meetings Calendar

JULY

National Housewares Manufacturers Association—Convention Hall, Atlantic City, New Jersey, July 13-17.

Western Summer Radio-Television & Appliance Market—Division of Western Home Goods Market, Western Merchandise Mart, San Francisco, Calif., July 20-24.

Southeastern Electric Exchange — Personnel Administration Section, Grove Park Inn, Atlanta, Ga., July 30-31.

AUGUST

Hoosier Electronic Conference—French Lick Sheraton Resort Hotel, French Lick, Ind., August 9-12.

International Association of Electrical Leagues—24th Annual Meeting, El Cortez Hotel, San Diego, Calif., August 11-14.

• **American Institute of Electrical Engineers**—Sixth Electrical Conference of the Petroleum Industry, Wilton Hotel, Long Beach, Calif., Aug. 23-26.

International Association of Electrical Inspectors—Northwestern Section, Seattle Hotel, Seattle, Wash., Aug. 24-26; Southwestern Section, Flamingo Hotel, Santa Rosa, Calif., Aug. 31-Sept. 2.

International Association for Hydraulic Research—Eighth Congress, Montreal, Canada, Aug. 24-28.

Metallurgical Society of the American Institute of Mining, Metallurgical and Petroleum Engineers—Statler Hotel, Boston, Mass., Aug. 31-Sept. 2.

SEPTEMBER

Illuminating Engineering Society—Annual National Technical Conference, Fairmont and Mark Hopkins Hotels, San Francisco, Calif., Sept. 7-11.

Maryland Utilities Association—Annual Fall Conference, The Cavalier, Virginia Beach, Va., Sept. 11-12.

National Electrical Contractors Association—Annual Convention, Waldorf Astoria Hotel, New York City, Sept. 13-17.

Edison Electric Institute—EEI-AGA Accounting Division & Section Organization Meeting, Hotel Cleveland, Cleveland, Ohio, Sept. 14-15; Meter and Service Committee, Hotel Wentworth, Portsmouth, N. H., Sept. 14-16; Industrial Power & Heating Group, Treadway Inn, Niagara Falls, N. Y., Sept. 17-18; Industrial Relations Committee Twelfth Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 21-23.

Electric Companies Public Information Program — Workshop Conference, Warwick Hotel, Philadelphia, Pa., Sept. 16-17.

Northwest Public Power Association—Power Use Workshop, Ephrata, Wash., Sept. 16-18; Accounting and Financing Workshop, Clark County PUD community room, Vancouver, Wash., Sept. 30-Oct. 1.

Public Utilities Association of the Virginias—41st Annual Meeting, The Greenbrier, White Sulphur Springs, West Va., Sept. 17-19.

Instrument Society of America—14th Annual Conference and Exhibit, International Amphitheatre, Chicago, Ill., Sept. 20-25.

• **Third Industrial Nuclear Technology Conference**—Sponsored by the Armour Research Foundation and Nucleonics magazine, Morrison Hotel, Chicago, Ill., Sept. 22-24.

• **Special Technical Conference on Non-linear Magnetics and Magnetic Amplifiers**—Fourth Annual Meeting, sponsored by AIEE and IRE, Shoreham Hotel, Washington, D. C., Sept. 23-25.

• **Second Electric Utility Seminar**—Sponsored by the System Planning Committee of the PEA, Penn State University, State College, Pa., Sept. 23-25.

• **Missouri Valley Electric Association**—Accounting Conference, President Hotel, Kansas City, Mo., Sept. 24-25.

• **National Power Conference**—Sponsored by American Society of Mechanical Engineers and American Institute of Electrical Engineers, Muehlebach Hotel, Kansas City, Mo., Sept. 27-30.

• Additions this week.

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Burndy underground connectors are still in service after 20 years, despite prolonged exposure to such hazards as dampness, oils and extreme ambient temperatures. To make sure that connectors withstand severe conditions even better than cables and protectors, Burndy *"Total quality control"* puts underground connectors thru whole series of tests, including these for the insulation alone:

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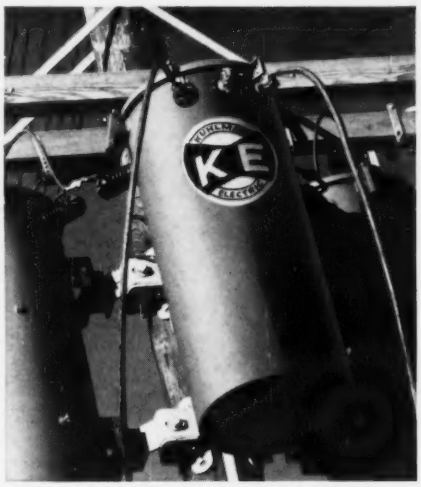

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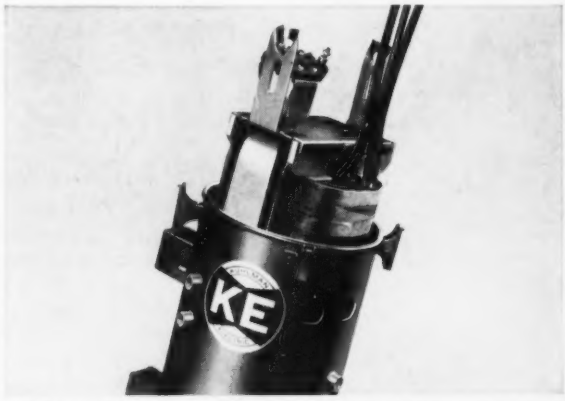

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